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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

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Railway Development.

Users of British railways are apt to present a paradoxical front. They are proud of the speed, the safety, and the reliability of the services, yet they are never tired of criticising what they believe to be the backwardness, in certain respects, of these transport systems. The two things are, to some extent, complementary, for the relative inelasticity of railway organisation, while due partly to the size of the concerns and their decentralised character, is due also to obligations laid upon the systems by Parliament. The railways, however, are making valiant efforts to adapt their organisations to to-day's needs, and in this respect no railway is more worthy of commendation than the London Midland & Scottish Company. In appointing Sir Josiah Stamp as President the Directors took a novel line, which seems to have been wholly beneficial. At the recent Conference of the Institute of Transport Papers were presented by officers of the L.M.S. on Rationalisation, Scientific Research, and on Costing, with a view to showing what had been accomplished in following out the new scheme.

Mr. Lemon's Paper is a remarkable illustration of the application of rationalisation to a railway system. Mr. Wood presented a Paper on the development of costing methods which offers useful hints to anyone concerned with this problem. In the remaining Paper Sir Harold Hartley, who is the Vice-President in charge of works, and Director of Scientific Research, deals with the organisation of the research side of the line. The Director of Research has a small secretariat and a Research Committee comprising the chief technical officers of the Company, with a group of distinguished scientists concerned with engineering, chemistry, and physics. Among the first problems to be tackled were the maintenance of rolling-stock and fuel economy. The line has a number of laboratories at various points, but it is part of the policy of the company to make use of outside specialised facilities and institutions—particularly the national laboratories, and the Research Associations.

Space does not allow us to go into any detail about the work done, but the Papers will be found extremely stimulating and well worth perusal by all connected with industrial operations; they form a tribute to the energy and enterprise with which the re-establishment of railway transport is being tackled in this country. In the minds of intelligent railway users they will be a more acceptable form of propaganda than any amount of special pleading and advertising.

Proving the Obvious.

Recent thought amongst the largest manufacturers of standardised articles is in the direction of making manual work less laborious rather than in the elimination of labour. It is more of a platitude than a reality, because obviously if a man does a maximum of work with a minimum of energy expenditure more work will be completed by him as an individual in a given period of time. However, it is not our intention to question the logic of the captains of industry. Rather do we wish to draw attention to an article which appears elsewhere in this issue, "The Rationalisation of Manual Labour by Industrial Physiology." Before printing it we discussed the experimental methods used with a well-known Harley Street physician, as we normally distrust tests on human beings, for they rarely conform with "K"—a mathematical constant. However, somewhat to our surprise, he certified the reliability of the method of attacking the problem. The results would not be vitiated by a sleepless night, food or drink. The question that arises is: Are such experiments worth while in British foundry practice? One of the chief points made as a result of this investigation is the amount of energy expended at riddling. Yet surely this is labouring the obvious, as every moulder knows. Or again, the experiments show that the more work done by the machine the less there is for the operator! We agree that the experiments are extremely interesting, but reveal nothing which could not be deduced by an astute observer of moulding processes. The concrete realisation of these deductions is noticeable in modern moulding-machine design, where push-button, knee or foot control is supplemented by placing all tools in a handy position. Or again, where flat ramming is necessary for finishing-off a jar-rammed mould, a pneumatic rammer is rendered easy of access by suspending and counterweighting. Our admiration for the novelty of the experiments detailed is in no way diminished by our conclusion that confirmation by British workers would be a waste of time and calories.

XUM

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Ganister Costs in Cupola Melting.

To the Editor of The Foundry Trade Journal.

Sir,—On the above subject your metallurgical correspondent has quoted some interesting figures, but I would appreciate knowing whether the costings refer to the *same* ganister sold at different points and due to railway rates, costing 20s., 25s. and 30s. per ton respectively. If, however, these three prices refer to *different* materials as used by the plant cited, then the quantities used per ton of metal melted will not remain constant, because obviously the ganister at 20s. per ton will be inferior to that which commands 30s. per ton, and consequently a greater quantity will be consumed.

The actual quantity of cupola daubing used is an interesting point, because there are certain other economies incidental to the employment of a first-class product which are not always appreciated at first sight by the consumer. For example, the use of a cheap material must mean that so much more is required to keep the lining repaired than when a first-class article, costing more per ton, is used. Where does that extra daubing go? Obviously it fuses and combines with other impurities to make slag. Thus a saving in quantity of patching must reflect a reduction in the slag output. Frequently a founder finds himself compelled to pay several shillings per ton to get his slag carted away. Again, the minimising of the slag must mean the minimising of the flux, as well as a cleaner and hotter metal.

Once again, the necessity of using less patching must indicate that the cupola lining is being better preserved, and therefore its useful life is much enhanced. In instances known to the undersigned, the lining life has been as much as doubled by the adoption of a really first-class repair medium. A still further saving can be made in fuel, for heat units normally absorbed by the softening daubing are usefully diverted to the heating of the charges.

In conclusion, the higher-priced material may easily be the cheaper to employ and *vice versa*. How dangerous therefore to attempt to discriminate between this or that material on its price per ton!—Yours, etc.,

L. N. Wilson.

119, High Holborn,
London, W.C.1.
August 15, 1932.

[We understood from the reading of the article that one reasonably constant material was used throughout, and that the prices quoted are purely hypothetical.—Editor.]

Porous Brass Castings.

To the Editor of The Foundry Trade Journal.

Sir,—Will someone advise me as to what may be the cause and how to overcome the following difficulty?—Occasionally I find that our brass castings are full of little pinprick holes. The last lot made, weighing from 40 to 60 lbs. each, had to be condemned after a certain time had been spent on machining. Our mixture is about 50 per cent. good heavy scrap brass, 45 per cent. pure copper and 5 per cent. tin; to this is added say 1 per cent. of phosphor copper and a handful of borax.

We use Carborundum crucibles, with lids, of 150 lbs. capacity, and the smelting is done in a forced-draft furnace, which will melt the first charge in about 2 to 2½ hrs., but the following charges in about 1 hr. to 1½ hrs. Sometimes the castings come out fairly well, but on other occasions they are full of tiny little pinholes. What may be the cause and how can this be rectified? Our moulding sand is pretty porous, and the moulds are evenly rammed up, well vented and partly dried.

Any information will be much appreciated by

"Central Africa."

July 21, 1932.

To the Editor of The Foundry Trade Journal.

Sir,—I shall be greatly obliged to receive through the medium of The Foundry Trade Journal information on modern methods of the process of tinning the insides of cast-iron pots and saucepans. We are manufacturing these in small quantities, but our present method of tinning is not satisfactory.—Yours, etc.,

Jos. H. Quicke, M.I.Brit.F.

Leacock & Company, Funchal, Madeira,
August 9, 1932.

Cornwall in Foundry History.

In the course of an interesting Paper on the iron foundries of Hayle, given by the President, Dr. J .Hambley Rowe, at the Summer Meeting at Falmouth, on August 10, of the Royal Cornwall Polytechnic Society, reference was made to the fact that for 100 years Messrs. Harvey & Company produced a vast amount of various machinery, and that in 1846 that firm and the Perran Foundry Company, Perranwell, shared a contract for pumping machinery for lakes in Holland. The Severn Tunnel is also drained by six large engines, which pump twenty to twenty-eight million gallons of water daily, supplied by the firm. The lecturer said the cause of the decline of the foundry was not far to seek, for it was influenced by the decline of the Cornish mining industry and increasing competition from the Midland engineering firms and from foreign countries. Mention was made of gates for Falmouth docks and Clifton Suspension Bridge made by the Copperhouse Works, and of ingenious machinery constructed by Cornishmen for high-altitude work in Lima and Peru. Dr. Rowe acknowledged his indebtedness to a history of foundry work in Cornwall compiled by the late Captain Stephen Mitchell, who died at Hayle, and who was greatly interested in engineering.

Discussion followed the reading of the President's Paper, and Mr. J. Chellew, of Falmouth, remarked that for many years the late Capt. Mitchell was secretary of the firm of Messrs. Hosken, Trevithick & Polkinhorn. He said that one of the greatest men Hayle had produced was William Husband, who invented the double-deep valve and pneumatic stamps.

Mr. W. Tregoning Hooper, of Falmouth, declared that Cornwall had made an enormous contribution to the progress of engineering in the world, and its story had never been fully told. Most of the chief executive positions in the American mines, he observed, were now held by Cornishmen.

Camber—A Practical Discussion.

Through a curious combination of circumstances, the contribution by Mr. R. A. Miles to the discussion on Mr. E. Longden's Paper was ascribed to Mr. John A. Smeeton in the report published on page 83 of our last issue. We very sincerely apologise for this mistake to Mr. Miles, Mr. Smeeton and the author.

(Concluded from previous column.)

Belts run twisted must have 30 per cent. higher capacity than open drives.

Random Shots.

In Brief.—1.

The Seven "Ages" of Man.

Baby carri——
Tutel——
Eng——ment.
Herit—— (failing this, Mr. Dr——).
Marri——
Parent——
Dot——

* * *

A wireless comedian told a rather neat story recently. His wife and he, he said, were in the "iron and steel" business. His wife ironed all day; he stole all night.

* * *

A correspondent very kindly sent along to "Marksman" the other day the following wise-crack—"all my own work," the letter states.

"Faithful unto death," they said, when they found the metallurgist lying between the metals.

* * *

Another correspondent, who signs himself "Father of Twelve" ("Marksman" envies him his income-tax rebate), has written to the Editor:—

Sir,—With reference to "Marksman's" maiden speech to be made to the members of the Institute, it would appear to be impossible to criticise such a master of eloquence.

Might I very humbly suggest that a rather better opening would be as follows: "Gentlemen,—The Foundry Industry to-day may be likened unto a stag at bay belching forth flames and smoke with the volcanic fury of an iceberg afloat upon a desert of trade depression and national indifference. . . ." Should this not be, in "Marksman's" opinion, suitable for the opening, it can no doubt be embodied in his maiden speech.—Yours faithfully,

"Father of Twelve."

* * *

You may have noticed in the morning newspaper a few days back that a Czecho-Slovakian brewery has decided to pay its dividends in beer and not in kronen. Each shareholder is to receive the very handsome dividend of 22 gallons of beer, barrel-free presumably. The more one thinks of this arrangement, the more attractive it seems to grow. But, then, beer is a readily-disposable commodity. It would be a vastly different matter did a firm of, say, monumental masons decide to pay its dividends in a like manner: half-a-dozen granite crosses, suitably inscribed, per shareholder. And what of the crochety old bachelor with interests in a corset-manufacturing concern; what would he do, do you think, with a dividend of a dozen or two of pink silk things? Yes, it *would* be awkward. Unless, perhaps, he could claim friendship with a large circle of lady friends. They might accept them as "a matter of form."

* * *

"Marksman" has witnessed with mild interest the springing-up of a number of small factories along the arterial roads, at a distance of ten or twelve miles from central London. In the majority of cases they are quite pleasing to the eye, carried out in white concrete, and designed in the current Teutonic style, severe and angular. The curious thing about these new buildings, as observed by this humble scribe, is that so many of them carry a smallish "conning tower" construction on the roof, just above the front entrance. At present he hasn't yet fathomed what purpose these can serve. What seems to him a reasonable theory is that they are look-out posts. When supplies run low a shop-boy is sent up aloft with a telescope, to spy out the approach of relief supplies.

Marksman.

The Openshaw Foundry of Joseph Stubbs, Limited.

Foundries catering for the textile industry have imposed upon them demands for grey-iron castings possessing a combination of soundness and ease of machining rarely encountered in any other branch of the foundry industry. Due to their success in this particular field, they have in the past surrounded themselves with a veil of secrecy often difficult to pierce. It was therefore pleasing for us when we received an invitation to describe the Openshaw foundry of Messrs. Joseph Stubbs, Limited. This works is purely the foundry section of the business, and the machining, fitting and erecting shops and drawing offices are housed in a separate establishment at Mill Street, Ancoats. There is, however, a well-equipped machine shop at the foundry, where machining of castings can be done, particularly high-silicon iron castings. From one point of view the existence of an engineering works of acknowledged efficiency is an advantage, as castings can be machined and assembled into machine parts or rough machined, or, again, just tested for machinability.

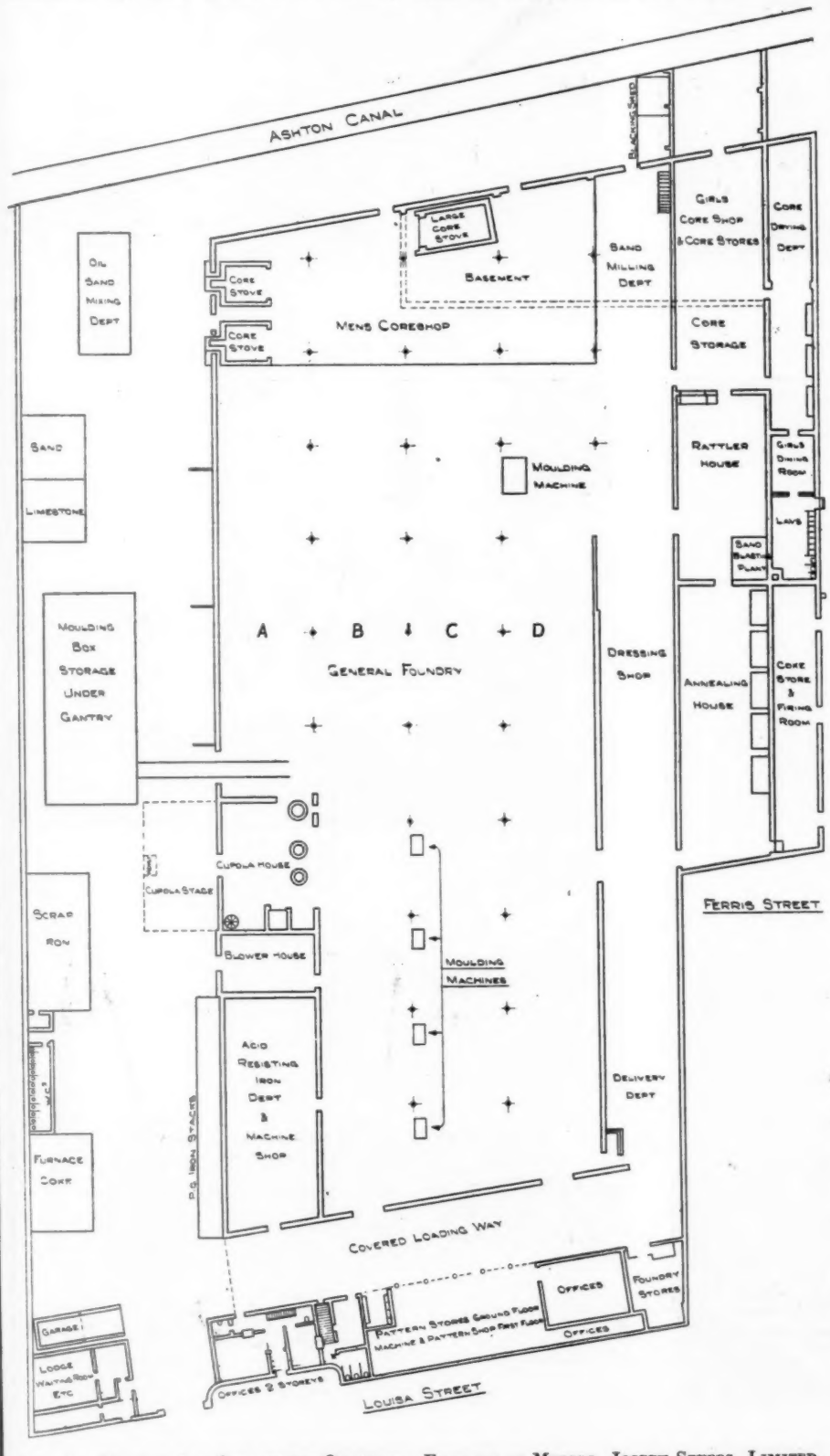


FIG. 1.—GENERAL LAY-OUT OF THE OPENSHAW FOUNDRY OF MESSRS. JOSEPH STUBBS, LIMITED.

The general lay-out of the Openshaw works is shown in Fig. 1. Raw materials enter from Louisa Street, the heavy and bulky commodities pass straight forward, whilst general stores turn right along a covered way leading from the despatch. Although this foundry was designed by the late Mr. Oliver Stubbs nearly 40 years ago, little improvement could be effected on the general lay-out, bearing in mind the wide range of castings made. Our visit was arranged by telephone, and no chance was given for tidying up of the yard, yet seldom have we seen a more orderly spick-and-span foundry yard. The coke is under cover, and the moulding boxes are stacked beneath a gantry, whilst we failed to detect even one anomalous plate or casting reared up against a wall, as is only too often encountered in foundry yards. A general feature of the foundry is that, apparently, the directorate for nearly four decades has been following the modern slogan of "Buy British." Yet we fail to see where it has suffered through its patriotic endeavours.

Melting Plant.

A local firm, Messrs Davies, of Gorton, has furnished the three cupolas, which are driven by a pair of Keith-Blackman fans. The largest is 4 ft. 6 in. dia. and the two smaller ones 3 ft. 6 in. The one nearest the returned scrap lift is mainly used for the production of high-silicon acid-resisting castings. The stage, it will be noted, is served by two hoists, because the type of manufacture creates large quantities of sprues and risers. The large cupola is so arranged that it can tap into either the heavy (A) or the general bays (B, C and D), Fig. 1.

The foundry, which is 320 ft. long by 280 ft. wide, is divided into a series of bays to take care of heavy, medium and light moulding, each bay being served by overhead travelling cranes of adequate capacity. The heavy bay, shown in Fig. 2, is served by a Vaughan electric overhead travelling crane of 15 tons capacity, supplemented by a number of 1-ton jib cranes. Here a portable sand slinger has proved itself as an efficient tool for taking the donkey work out of moulding operations. Any prejudice which originally existed has been dissipated and moulders now regularly seek its aid. The arrangement of this section could not very well be improved upon, as will be noted from Fig. I. The heavy moulding boxes and large patterns enter and the finished castings leave by a door at the cupola end of the bay. The cores are made and dried at the canal end of the shop. Thus for the making of these heavy castings—15 tons is the maximum—only short hauls are made for patterns cores, metal and the finished job. By using portable riddles, plus the work done by that attached to the sand slinger, much of the work of preparing the backing sand is done *in situ*. Facing sand certainly has to traverse the width of the shop, but, as will be seen from Fig. 3, the gangways of the foundry are furnished with light rails on which run bogey wagons.

Many of the moulds made in the floor are dried by an August Portable mould drier. When making castings, such as planer machine beds, extensive use is made of chills of the intermittent variety for the dual purpose of rendering the heavier sections dense and for reducing camber allowance.

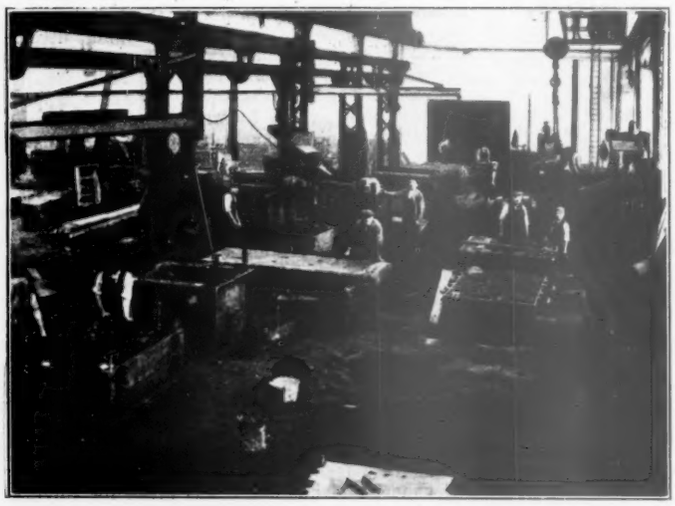


Fig. 2.—The Heavy Bay, showing Sand Slinger in Use.

Fig. 3.—General View of the Foundry.

Fig. 4.—Showing the Bay in which Medium-Weight Castings are made.

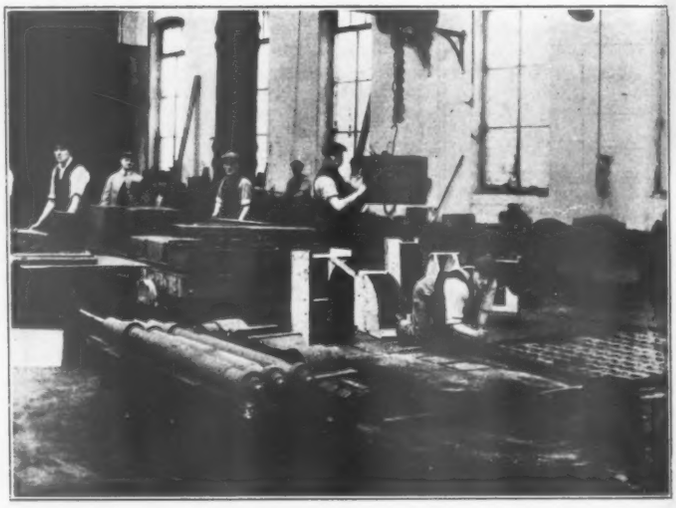


Fig. 5.—Men's Core Shop.

Fig. 6.—Girls' Core Shop, showing Method of Transporting the Cores.

Fig. 7.—Tumbling-Barrel Equipment.

Medium and Light Bays.

Spanning the bays constituting this section are four 3-ton, one 2-ton and one 30-cwt. overhead travelling cranes, mainly made by Vaughan. Here the majority of the light castings are made in green sand. Fairly large castings are made on a Jackman Osborne-type roll-over jar-ramming machine which has a lifting load of 2,000 lbs. There are four smaller machines of this type taking boxes 2 ft. 6 in. square. This shop is a typical example of the influence of local conditions on the choice of moulding machine. The type of sand readily available in the Manchester area demands much more care in use than, let us say, in Belgium, where the sands "stay put" much better, rendering rolling over almost superfluous. A dozen adaptable hand-ram stripping machines are utilised for an infinite variety of smaller work typical of those demands imposed by the textile industry.

Core Making.

Oil sand is mixed in a shed apart from the main building, as shown in Fig. 1. A machine by Foundry & Engineering Company, Limited, of West Bromwich, for drying the sea sand is installed, and a machine of the Spermolin dough-mixing type is used for mixing the sand with spermolin, which product is used solely by this firm. The larger cores are baked in a pair of Acme stoves, which are giving every satisfaction. Their internal dimensions are 10 ft. wide by 6 ft. deep. The carriages are handled in and out by mounting on a ball-race path. There is a third core stove of still larger capacity, but at the time of our visit it was out of commission. Small cores are made in a special shop by female labour. Many being delicate in character, care in transport to the ovens is essential. It is probable that this shop was one of the earliest to solve the problem of safe yet economic transport when, about 30 years ago, the management installed a runway carrying spring suspended 3-tier trays. One of these is clearly shown on Fig. 6. The core ovens are town's gas-fired, and ample storage is provided for the finished cores in the adjoining shop.

Cleaning and Finishing.

The smaller castings are put through tumbling barrels, the installation being shown in Fig. 7, the method of preventing dust from entering the shop being clearly indicated. In addition to these, there is a Jackman sandblast cleaning barrel. In just two other shops (we are aware there are some others) we have seen plant for the heat-treatment of grey-iron castings. Never before, however, have we seen such an extensive plant such as that shown on Fig. 8 for the routine of annealing by packing the castings with iron ore in cans, just as in the malleable castings trade. Naturally, the heat-treatment is not so prolonged. It certainly does ensure that the customer is getting really soft machinable castings, and, moreover, it is a service which the buyer should consider and be prepared to pay for. The fettling shop resembles that of a hard barrelling shop in a large malleable foundry, and sorting the multitude of toy-like castings is indeed a formidable problem. The extent of this shop can be gauged from Fig. 9. A battery of double-ended grinders, fettling, sorting and inspection benches allows of proper routing for the casting to arrive at the despatch department, where a fleet of lorries is available for rapid distribution throughout Great Britain.

Fig. 8.—Annealing Ovens in which Castings are Heat-Treated to Ensure Ease of Machining.

Fig. 9.—Dressing Shop.

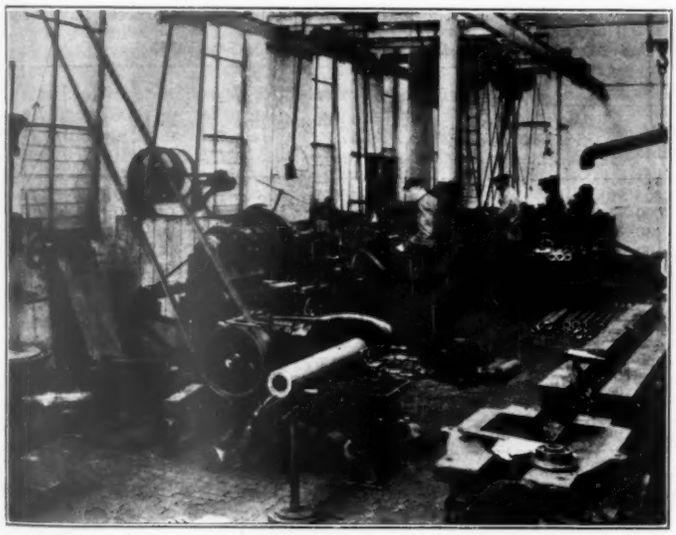
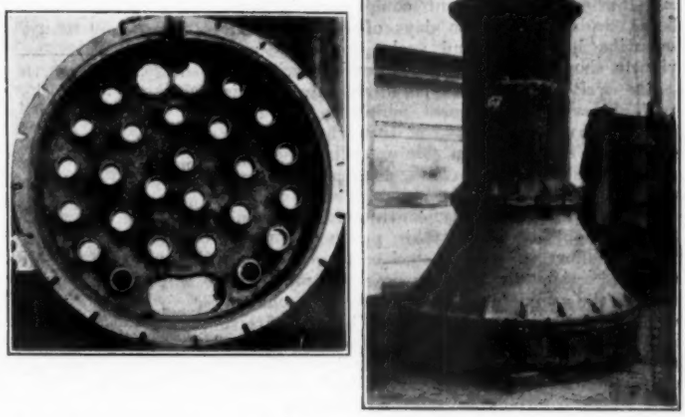


Fig. 10.—Machine Shop for High-Silicon Acid-Resisting Iron.



Figs. 11 and 12.—Show Samples of Acid-Resisting Iron Castings of the 12 per cent. Silicon Variety.

Acid-Resisting Castings.

The manufacture of high-silicon acid-resisting irons is an important feature of this foundry. They are cast adjacent to the department (Fig. 10) specially designed to take care of their fettling and machining. As soon as they are stripped, they are lowered into one of two pit furnaces carrying removable roofs in sections.

(*Concluded on page* 98.)

Salient Points of American Steel Founding.*

By F. A. Melmoth (Detroit).

Foreword.

The growth and development of the steel trade in the United States has been on a scale unparalleled in any country. It would be expected that in a comparativly new country, stocked with virile, enthusiastic pioneers, free from and unhampered by traditions, any expanding industry would be characterised by a robustness of outlook, somewhat difficult to attain and maintain in older countries more nearly approaching the height of their development. The steel casting side of the American steel trade is no exception, and this is confirmed by the fact that the production of steel castings in the year 1900 was 172,145 tons,† a figure which has grown in 1929 to 1,413,428 tons. Only a successful industry could show such figures of expansion, and no indication exists of any lag in speed on return to normal times. The question naturally arises in the mind of the student of American steel foundry conditions: "What are the real causes and controlling conditions resulting in such growth?"

The writer received his early education and technical training in Europe, has been domiciled in the United States during the last few years, and actively engaged in its steel-founding industry. Any of his remarks, therefore, cannot be interpreted as the result of over-stimulated national pride, excusable as this may be in the American-born citizen; his opinions must come as a result of conviction arising out of personal observation. It is not uncommon in European business and in technical circles, to place basic responsibility for American rapid progress on the immensity of demand, and to conclude that with their smaller schemes of production, their success in such production must be necessarily more limited. Intimate contact with the industry of this country for a reasonable period demonstrates the fallacy of this conclusion. Were the product unsatisfactory, no more general business development could save it from being replaced in these days of technical and scientific ingenuity, and such growth as previously shown would be an impossibility.

The writer's opinion, based entirely on his own observations, to meet which he has been given every opportunity, is that the size and growth of the American steel-founding industry is due to two factors: first, a progressive and aggressive attitude on the part of steel founders, calculated to discover a continuously growing field of application for their product, coupled with an effort to make a steel casting the most obvious article for the purpose desired; and second, the completely free and open interchange of ideas and opinions which exists between firms, individuals and organisations. These two factors result in an enthusiasm for their job which is characteristic of the American steel founders, and which is prominently evident to any newcomer to the country. Such progressive thought and enthusiasm are surely the greatest single causes of success in any industry.

Steelmaking for Castings.

All the recognised methods of steel production are in operation in the United States for the manufacture of steel castings. In 1929 the total number of tons of castings produced by process was as below‡:—

	Tons.
Basic open hearth	525,190
Acid „ „	485,782
Bessemer	27,526
Crucible	794
Electric	374,142

A study of the production figures back to the year 1900 shows the following tendencies. Basic and open-hearth castings have steadily increased, and account between them for two-thirds of the total steel-casting production of the country. Since the year 1918 there has occurred an almost coincident fall in the production of converter-made steel castings, and in 1929 this method only accounted for one-fiftieth of the total production. Accompanying this reduction, and possibly accounting to some extent for it, a rapid increase has occurred in the amount of electric steel castings produced. This material began to assume real proportions in 1918, and from then to 1929 multiplied in quantity by four times. In the latter year, electric castings amounted to over one-quarter of the whole steel castings production.

The production of crucible steel castings represents only an almost negligible proportion, being 794 tons in the year 1929, having fallen to this figure from a maximum of 15,652 tons in 1913. These figures give a good picture of American steel castings from the point of view of process, the really outstanding feature being that of electric steel castings, which indicates the growing popularity of this method for the purpose.

Open-Hearth Steel.

As in all other steelmaking countries, this process, in its variants of acid and basic, constitutes the backbone of all large production of steel. Steelfounders in this country have realised the advantages of heavy charges and consequent economic production, and the control of method offered by the process also makes it ideal for general forms of castings. The process has been also assisted in maintaining its popularity by the existence of large quantities of cheap fuel; both oil and natural gas are available in many localities, and alternatively in all, and have proved themselves easily adaptable for use in the furnaces. Metallurgically, the processes are operated almost identical with European and other practice, and the steel made for castings, coming under the writer's observation, is of consistently high quality.

From the standpoint of consistency of production, the following examples of monthly averages of analysis represent one foundry with which the writer is familiar, and the figures can easily be duplicated in many foundries. Figures of physical properties are given in the table, and variations from the average will be seen to be very small indeed. It is emphasised that the 303 charges represent the whole of the production made under test in the specified period, and no omissions of any indifferent results have been permitted.

It will be admitted that such figures indicate strongly that general steel production in American steel foundries has before it a high standard of quality, and it is repeated that the instance given is merely typical, the writer having had opportunities of perusing records of many foundries. The most striking point to a newcomer, on examining modern American open-hearth furnaces, is the degree to which engineering ingenuity has been adapted to them. Controlled forced draft, temperature control in checkers, efficient insulation wherever practical, have combined to place combustion of the fuel under perfect control, with a consequent high degree of efficiency. The significance of slag constitution is fully appreciated,, and all efforts are made to produce steel free from injurious non-metallics and gases.

The writer has also been struck by the fact that in some foundries open-hearth steel is used for very light castings. In one foundry recently visited, many thousands of castings weighing 10 to 12 lbs. each, and of thin section, were being produced, the melting unit in use being a 27-ton open-hearth furnace. The castings were of excellent quality and finish, and the percentage of misruns very low indeed. This indicates that although the generally accepted opinion is that the open-hearth is, *par excellence*, the process for heavy castings, the American edition of it, equipped with modern control apparatus, is quite capable of taking care of a very wide range in sizes of castings.

Electric Steel.

The great bulk of steel produced in this country from electric furnaces is made on acid linings. For certain special purposes basic linings are utilised, but such cases are very rare. The characteristic recommendation for the electric process being its ability to make small charges of varied analyses, hot and fluid, for the smallest type of castings; it is natural that the main developments of the process have been in foundries dealing with light work or that demanding alloy compositions. Machine-moulding methods and green sand developments have also a bearing on the popularity of the process. With moulds being produced at present-day speeds in green sand which depreciates on standing, it is obvious that both economy of space and success of the castings are dependent upon a regular supply of steel at frequent intervals. The basis of rapid production is continuity, or the exclusion of waiting-time periods and consequent accumulations. From this viewpoint, the converter might be said to hold a pre-eminent position, but unfortunately the necessity for large proportions of expensive pig-iron, and the apparently inevitable high melting loss, have combined to cause the wane of this process. The electric furnace is filling the gap, being able to produce hot steel at frequent intervals—although not so frequent as the converter—while utilising cheap steel scrap and little or no pig-iron; also possessing ability to melt with very low losses.

Average of All Tests Made on Open-Hearth Carbon Steel during the Year 1930.

	Lb. per sq. in.			Red. of area. Per cent.	C.	Mn.	Si.	P.	S.	No. tests.
	Tensile strength.	Yield point.	Elongation. Per cent.							
January ..	73,540	40,408	29.10	50.02	0.24	0.68	0.31	0.044	0.038	29
February ..	73,480	40,000	29.30	51.29	0.25	0.72	0.32	0.040	0.034	23
March ..	73,681	39,160	28.84	50.50	0.25	0.68	0.30	0.040	0.034	44
April ..	72,880	40,100	28.73	52.33	0.25	0.74	0.31	0.042	0.036	48
May ..	70,784	38,451	27.89	48.35	0.23	0.64	0.32	0.044	0.035	29
June ..	72,780	39,500	28.75	51.61	0.25	0.66	0.31	0.042	0.038	33
July ..	71,980	40,173	27.80	49.90	0.27	0.66	0.32	0.044	0.040	13
August ..	71,104	40,291	29.66	47.15	0.26	0.74	0.31	0.042	0.039	12
September ..	70,240	38,557	30.60	47.72	0.28	0.79	0.33	0.044	0.040	13
October ..	73,220	40,190	29.60	48.60	0.25	0.67	0.33	0.042	0.038	25
November ..	73,318	40,988	27.70	44.91	0.26	0.67	0.31	0.045	0.039	22
December ..	71,909	42,568	30.29	47.01	0.25	0.67	0.29	0.039	0.032	12
Average, 1930	72,409	40,032	29.02	49.11	0.25	0.69	0.31	0.042	0.037	303

* Presented before the 1932 meeting of the Australian Bureau of Steel Manufacturers as the Exchange Paper of the American Foundrymen's Association.
† Metal Statistics, 1930.
‡ Metal Statistics, 1931.

On the score of comparative quality of the product of the two processes, the writer hesitates to be dogmatic. Very carefully made converter steel is capable of producing perfectly good castings. The time periods associated with the vital reactions of the process are, however, very short, and possibility of the correction of judgment errors by the operator consequently limited. On this account, except where the converter is in very good hands, the writer would be inclined to favour the acid electric process as being free from failures owing to the human controlling element, and so all the more likely to produce satisfactory material, both regularly and consistently. This obviously must be the considered opinion of the American steel founders in general, as instanced by the rapid growth of the acid electric process, and the coincident decrease in the use of the converter.

Taken generally, there is no indication that the ultimate quality of castings produced by acid electric furnaces is superior to well-made open-hearth castings, as the writer himself would expect. The critical reactions of the two processes are practically identical, the only essential difference is in the source of heat supply. Many extravagant claims of advantages in quality for electric steel have been made, and such claims in the long run, can be only detrimental to real progress.

The considered American opinion could be taken as represented in their appreciation of the great value of the process for handiness, in that it enables many varied analyses of steel to be produced in any desired small quantity; in ease of control, both mechanical and metallurgical; and in enabling high-temperature production, so that thin, small castings can be produced satisfactorily. These characteristics are sufficient to justify fully the standing achieved by the electric furnace as a practical steel process, without the addition of any of super quality in excess of that conferred by any other process.

Equipped with a basic lining, it is true that unusually low-sulphur and phosphorus content can be assured easily, but modern thought in steel castings deprecates an excessive importance being given to abnormally low sulphur and phosphorus as a material indication of casting quality. It is admitted that excess in either or both of these elements is detrimental, but figures of 0.05 to 0.06 of either, in the writer's experience, have never been proved to be responsible for any shortcomings in behaviour of service or for mechanical test properties. Steel scrap can be obtained easily for use in acid-lined furnaces containing considerably less than these limiting figures, and therefore the refining advantages of the basic furnace become unnecessary elaboration. Further, the writer, and many of his colleagues, with experience of both acid and basic processes, are of opinion that acid electric steel is easier to handle. It appears to possess a fluidity and consequent ability to be hand-shanked, in excess of steel of equivalent composition produced in a basic-lined electric furnace. It is controversial as to whether this is due to the presence of quantities of oxides differing in the steel after finishing. It is logical, however, to believe that the strong reducing condition commonly produced in a basic-lined furnace during the final period of the working of the charge—a condition essential to satisfactory desulphurisation—should result in a minimum presence of oxides in the bath of metal. It is also believed that intensification of these reducing conditions, or prolongation of their time period, results in an exaggerated form of sluggishness or lack of fluidity. Whether such explanations are accurate cannot be definitely determined, but the trend towards acid production, where electric steel is needed for thin and small castings, would appear to show that general experience confirms these opinions. The basic process, however, due to an enhanced control over slag composition, possesses economic advantages in the case of expensive alloy steels. Such steels can be produced with practically no losses of alloy additions to the slag, and so regularity of alloy content is easily assured.

The latest entrant to the electric-furnace field is the high-frequency type furnace, and steel foundries with speciality products of the high-alloy type in this country are already installing them. Metallurgically, the process is one of dead melting, analogous to that of the crucible, but with the great advantage that the steel is not subjected to any gaseous atmosphere of a detrimental kind. In the ordinary crucible process—either gas or coke fired—large quantities of gases very easily penetrate the crucible at melting temperatures, and are apt to be absorbed by the liquid metal. The high-frequency furnace, being to all intents and purposes a closed crucible—melting temperatures being attained by the formation in the charge itself of heavy induced electrical charges, by means of coils in the lining—it is obvious that an almost complete freedom from gas absorption is assured, and the charge is melted to the calculated composition. For special purposes in expensive orders it is already safe to say that the process is established. The application of the furnace to general commercial steel castings stands to be economically demonstrated. Initial cost, due to the essential electrical apparatus, is high in proportion to the melting capacity of the unit. It is freely stated that current consumption per ton of carbon steel produced is very little, if any, higher than with the orthodox arc-type furnace.

Mould Production.

The operation of moulding might be described in two parts: firstly the making of the mould itself; secondly the mechanical contributory appliances associated with the operation. America being the home of motion study, and her schemes of production along many lines being dependent on the adaptation of the mechanical and exact to some form of human effort, it is only to be expected that foundries in the United States would adapt the idea in their own production. Greater application of the machine, and elimination of human energy, would be anticipated. Every known type of moulding machine is in constant use in American foundries. Squeezer machines, or combined jolt-squeezers for light work; jolt-ramming machines of various types for larger work, and the sand-slinger where its use is suitable and economical, are the machines generally used. To the observer experienced in foundry operations, all the common moulding methods, and the machines used, are similar in America to those now found in other countries, but, as stated, in the case of open-hearth furnaces, mechanical applications have been widely exploited.

The principle is fully appreciated that no machine can perform satisfactorily unless all contributory factors are given full attention. It is of little use possessing a machine with a potential moulding capacity of so many flasks per hour, and being unable to avail oneself of this, because flasks, sand and other materials cannot be provided at the necessary rate, or, alternatively, finished moulds cannot be despatched at the necessary speed. It is significant, therefore, that the attention of American steelfounders has focused itself on mechanical handling, at rates of speed designed to ensure co-ordination of supply, operation and clearing time. Sand is provided, prepared to specified standards, in the most convenient position to be fed straight to the flask. Adequate supplies of satisfactory flasks are available, and the rammed-up moulds, when of suitable type, are removed on conveyors. With progress at its present rate, it is safe to say that very shortly it will be highly improbable to see moulders in light- and medium-weight American foundries using shovels or handling rammed-up moulds.

It is obvious that to keep step with such moulding conditions, the class of pattern is important. There is an impression that for real production work expense on patterns is not spared, and first-class metal patterns are commonplace. While referring to moulding, there exists what would appear to the European viewpoint a weakness in existing American foundry conditions, in the arrangement to assure succession of skilled operatives. The writer is of opinion that founding, being in most of its branches a mixture of art and science, it will be a very long time before the application of mechanical genius can completely oust the necessity for highly-trained operatives. It is common in Europe for an adequate number of youthful apprentices to be accepted as a necessity in the organisation of the shop. The education and works-training of these boys is deemed essential for the supply of experienced moulders, and they are fostered and carefully supervised with this object in view. In the United States, while it is only fair to admit that this side of the question is receiving increased attention, it can be definitely stated that the training of youths for foundry employment is not given equal prominence. In the writers' opinion, there will always be a large amount of work calling for such trained skill, and it is difficult to see how craftsmanship can be replaced by mechanical arrangements. A controlling influence is undoubtedly the American educational system. Boys leave school at a later age than in Europe, and are given a type of education which, while it may be admirable, does not encourage a boy to be satisfied with a low rate of pay during an apprenticeship.

The solution of the problem will be assisted by the fact that American foundries are continually becoming more desirable places in which to work, and therefore should represent a greater attraction to boys desiring a career. In the meantime, schemes for the training of youths are being evolved, with the co-operation of manufacturers, educational institutions, and technical societies, which should ensure an adequate supply of skilled men in the future. The old idea of a foundry being a dirty place, suitable only to low-grade operatives, will have to be changed before the average educated American boy will consider a lifelong association with it.

Moulding Sand.

Naturally-bonded sands are available in America, and are of specified high quality, but the great bulk of the moulding sand used is synthetic; that is, it is composed of a base of highly-pure silica sand, to which is added the necessary bonding material. Whereas in Europe naturally-bonded sands play a very large part, it is believed in this country that greater regularity can be maintained by synthetic mixtures. This is perfectly logical. Bond type and distribution in most naturally-bonded sands are liable to irregularity, calling for continuous modification in sand preparation, and thereby destroying standards of practice. This is not universally true, but sufficiently so to warrant increased confidence in synthetic mixtures. American mentality leans always toward standardisation, and in sand preparation for castings this inclination is also significant. Instruments have been devised, and are in constant use, to test all sands for permeability and bond strength at frequent intervals. Care in the selection of the base silica sand, and the required binder, with consistent checking of each consignment, and with the use of the above testing methods, ensures sand to the moulders within practical limits of consistency in those factors which control the satisfactory production of steel castings. Almost all steel foundries employ some method of renovation. Both screening and pneumatic removal of fines are widely used. It is realised that only thus can consistent behaviour be expected from moulding sands. Consequently large proportions of used sand appear in the facing-sand mixtures, and economy in facing-sand cost is thus achieved.

So far as the writer is aware, there is no equivalent of the European "Compo" in use in American steel foundries. Sand mixtures are varied to suit different sizes of castings, but even

for very large castings it has been found unnecessary to resort to composition moulds. Viewed from the standpoint of results obtained, the present writer would say that steel castings in the American foundries he has visited possess an appearance and easy cleaning quality well up to the highest standard exhibited by any other country. Requirements in the surface finish are just as exacting as those existing elsewhere, and the industry as a whole is meeting those requirements. The answer to the whole question is to be found in an insistence on regularity; regularity of original sand, regularity in its preparation, and regularity in the making of the moulds. To this end, all efforts are concentrated continuously, and research to improve this factor is being consistently carried out.

Cleaning.

At one time, the cleaning room was in the nature of a bottle neck in most steel foundries. It is now fully realised that the ultimate result of any production scheme in the steel foundry itself is nullified entirely by inefficient cleaning-room arrangements, and close attention has been given to the ensuring of equal speeds of cleaning in relation to production of castings. Efficiency in this respect depends upon two main points. Cleaning being a purely mechanical series of operations, efficiency in the plant's mechanism is a prime essential. So modern equipment is all designed with a view to dispensing with handling. Shot-blasting, for the removal of sand, is practically universal, and many ingenious designs of equipment for this purpose have been developed; minimising risk and discomfort at one time was always a source of danger.

Mechanical sprue cutters of various types, and efficient oxy-actylene burners, deal adequately with the removal of heads and gates. Peripheral speeds of grinding wheels have been sharply increased, following development in wheel production, thus shortening the period occupied by grinding in a marked fashion. All these developments are common to American steel foundries, and improvements continue. From the mechanical standpoint, therefore, by reducing handling and the time periods for cleansing operations, great steps have been taken towards removing the general conception of the cleaning room, as a place regarding quick deliveries. In the opinion of the writer, however, a factor of at least equal effort has been in operation outside the volition of the cleaning room itself. Next to performance in service, or characteristics revealed by machining operations, the steel foundry's own cleaning room is the index to the efficiency of the foundry in their production of castings. It has been truly said that the cleaning room possesses no problem of its own; they are all inherited. Sand and metal control, improved methods of heading and gating in the foundry by producing castings easier and cheaper to clean, have largely dealt with the problems at one time associated with cleaning steel castings. It has also become common practice to consider the economics of the cleaning room when planning methods of gating and feeding. It is safe to say that a mental viewpoint which includes the cleaning room, developed in the minds of those foundry operatives responsible for casting methods, can do more to reduce cleaning-room costs than any other factor.

Heat-Treatment.

Almost all steel castings made in this country are subjected to some form of heat-treatment. Engineering development which calls for increasing capabilities in performance have rendered this an almost universal necessity. It is realised that in the "as-cast" condition a large part of the potentialities of performance of a steel casting remains locked up and unavailable in service, able only to be freed by adequate structural modification through heat-treatment. For specific purposes, every modification which can be covered by the term "heat-treatment" is regularly in use, ranging from straight annealing, through normalising, or normalising followed by a draw, to liquid quenching and the necessary draw. Efficient treatment demands good equipment, and American steel foundries as a whole possess furnaces of satisfactory types. Designed for even heat distribution, and efficiently insulated, they are both efficient and economical in use. Automatic temperature control is largely used, and is indeed almost a necessity. The most popular type of furnace is the car type, with mechanical operation of all moving parts. Furnaces are available fired either with natural gas, producer gas or oil, or heated by electricity, which vary somewhat according to district, affecting the economic choice of method.

Oil being comparatively cheap, probably the most popular furnace is one of the car type, mechanically operated throughout, with automatically-controlled multiple oil burners. Carefully adjusted, such a furnace possesses a good even heat distribution, and when insulated is remarkably economical in operation and maintenance. The electrically-heated furnace, deriving its heat from a series of well-disposed resisters, represents the acme of even temperature distribution, and atmosphere control, and where the price of electricity is sufficiently low, is a very attractive proposition for the closely-controlled type of heat-treatment demanded by many modern steel castings. Related to heat-treatment is the question of demanded specifications. A perusal of the more common ones indicates that for equivalent purposes American specifications are no less exacting than those operating in other countries. Dealing specifically with steel castings, it is noteworthy that there is a greater insistence on yield point and reduction of area in American specifications. This is significant, in that it is the common belief that these two factors are of great importance, and are the real indications of quality of the product. It is certain that their relation to heat-treatment is significant, as in mild steel castings no other factor so quickly indicates either the absence of treatment or its unsatisfactory performance.

Special Steels.

Very few foundries limit their production in these days to plain carbon steel castings. All the commonly-accepted alloy-steel compositions are available for casting, and the indications are favourable to an increase in their use. Knowledge of the behaviour of alloy steels in casting form does not abound everywhere, but is continuously being accumulated. The ideal method for fitting the steel to the casting is developing, and the wide range of varying compositions, each possessing individual characteristics, gives the designer a wide field of choice. It is now fully realised that the performance value of an alloy steel is not indicated by composition data alone, but that each type calls for individual heat-treatment.

Engineering development in the United States is very rapid, and the steel founder, if he is to keep his place as a supplier of materials, has to face the fact that materials of special capabilities must be continuously forthcoming. High speeds, high pressures, and high temperatures, and lightness in moving parts are the order of the day, and in steel castings, just as in any other branch of the steel trade, call for something better than the ordinary variety of mild steel casting. That these demands are being continuously and in the main satisfactorily met, indicates a healthy condition of growth in knowledge of special steel on the part of steel foundrymen. At the present time there is a plethora of types of alloy steels available for use in steel castings, and their number is constantly increasing. The physical characteristics in many cases duplicate one another, and often the use of a certain steel for a particular purpose is controlled by either the desire of the purchaser or the individual opinion of the manufacturing foundry. The following list gives some little idea of the many types most commonly in use:—

Structural and General Engineering Purposes: Carbon-Molybdenum, Carbon-Vanadium, Nickel, Nickel-Manganese, Manganese-Molybdenum Nickel-Chrome—with varying Nickel Content up to 3½ per cent., Nickel-Vanadium, Chrome-Vanadium.

Combined High Temperatures and Pressure: Nickel-Chrome and Nickel-Chrome-Molybdenum.

Resistance to Abrasion: Manganese Steel, High Carbon Nickel-Chrome, Chrome-Molybdenum—of varying carbon content and treatment.

High Temperature Service (Scale Resistant): Nickel-Chrome—with varying alloy content up to 65 per cent. Nickel and 18 per cent. Chrome, depending on operating conditions, Chrome-Silicon, High Chrome Steel.

Corrosion-Resisting Steels: Nickel-Chrome, of the 18/8 or similar type, Rustless Iron, Low Carbon High Chromium, Stainless Steel, medium Carbon High Chromium.

While this list does not claim to be in any way comprehensive, it will be seen that American engineers have an adequate field of choice in specifying steel for castings required for special purposes.

Attitude to Research.

There is probably no industry where it is more vital that continuous research inside the industry should be carried out, than that of founding. The number of operations and influences on the basic material used is legion, and the controlling factors of these influences must be understood if success is to be obtained. Research in America has grown with industry, and there exists practically no traditional prejudices to overcome. In all branches, continuous research for better methods for complete control is proceeding. The adaptation of this method of thought into steel founding has been followed by quite rapid development. Investigation into moulding sand, as an example, has resulted in the evolving certain standards, and the development of instruments, simple for use, to establish control over sand mixtures so that the standards may be maintained. In steelmaking for castings, careful observation and investigation has demonstrated the necessity for particular care in furnace manipulation, if steel is to be able to withstand the unsettling mould effects. Studies of the response of cast structures to heat-treatment have resulted in definite knowlege as to time and temperature in relation to mass of casting, whilst continuous investigation into solidification conditions has been the means of evolving better methods of gating and feeding.

A combination of these and similar types of research has undoubtedly raised the standard of steel-casting production, more particularly from the viewpoint of appearance and internal soundness. A continued and extensive investigation into the matter of design will be followed by even more marked results. The question of research into foundry fundamentals is always a live subject for discussion among American foundrymen, and the avowed object of it all is "control"; control of those vagaries to which steel castings were at one time notably liable; control of the expenditure of time and its correct use; control of expended energy to produce a given article; and finally, the control of those factors which by their absence or presence definitely define the behaviour of the resulting casting to service conditions.

Associations.

In the Foreword to this Paper, it was remarked that a free interchange of ideas had exerted quite an influence on the progress of the casting industry in America. To the European, the American would appear to be a great believer in conferences and discussions. As a business

(*Concluded on page* 100.)

Rationalisation of Manual Labour by Industrial Physiology.

By Rene Leonhardt (Berlin).

In the experiments that have been performed to date on the expenditure of energy during work, the object in view has been in most cases an increase in the output of work by the elimination of inappropriate, unnecessary and time-wasting movements; in other words, better performance with the same expenditure of time.

Fig. 1.—The Application of the Respiration Apparatus with an Operative working at a Hand Press in the Foundry of Bamberger, Leroi & Cie, Frankfort-on-Main.

The experiments on the consumption of energy in the operation of moulding, which Dr. Ernest Simonson, the director of the Industrial Physiology Department in the Social Hygiene Research Board, Frankfort-on-Main, carried out in the foundry of a local firm, Bamberger, Leroi & Company, show that the better performance which rationalised management boasts of, is obtained at a cost of increased expenditure of energy (body fatigue) per unit time on the part of the worker. These results are not universally true for every kind of work. Each individual case must be tested by itself by the application of the highly-illuminating objective methods of industrial physiology.

Since it is mainly manual labour that one has to study, the expenditure of energy is obtained by the determination of the number of calories consumed. To do this the amount of oxygen taken in by the worker, the amount of carbon dioxide given off, and the amount of air used in the process are ascertained. For this purpose a so-called respiration apparatus (shown in use in Fig. 1) was employed, in which the main current of used air passed through a gas-meter, this measuring the amount of air used, while small portions were caught up in small rubber bags adapted to this end for chemical analysis.

As a subject for the experiments, a healthy worker was chosen who, on account of several years' experience, was able to perform the manipulation in the investigation with the same expenditure of energy as usually found in practice. His consumption of oxygen while at rest was first ascertained, and thus values for later calculation and reference were obtained. Experiments, in which a stripping machine (Process I), a hand-squeeze machine (Process II) and a hydraulic squeeze (Process III) were employed, were carried out to find out the total calorie consumption per unit time and per unit work. Process I consisted of 20 separate movements; Process II, of 16, and Process III, of 13. The number of calories needed for each move was ascertained in order to determine for which manipulation it would be expedient to replace manual labour with machines.

The results of the experiments are recorded in Fig. 2. This diagram shows that technical rationalisation in the Processes I, II and III leads on one hand to a reduction in the amount of energy consumed per casting from 11,497 calories per casting to 5,820 calories per casting in spite of an increase in production from 0.353 casting per min. to 0.978 casting per min. On the other hand, it causes a rise in the expenditure of energy per unit time from 4,049 cal./min. to 5,640 cal./min. The increased efficiency obtained with the aid of better technical equipment was attained only by a greater demand upon the worker.

Fig. 2 further shows that Process II must be marked as inferior to Process III from the point of view of industrial physiology. The amount of energy needed in Process II is not much less than that required in Process III (5,110 cal./min. to 5,640 cal./min.) in spite of the fact that it produced only half as many castings as Process III (0.518 casting/min. to 0.978 casting/min.).

When, in the Processes I and II, at the sifting of the facing sand, manual labour was replaced by a pneumatic shaking device, there resulted an increase in the output and a reduction in the expenditure of energy per casting output in all three processes (Fig. 3).

The results that were obtained in the investigation of the individual movements and which are recorded in Fig. 4 are worthy of note. One sees that the ramming operation in Process I requires the highest expenditure of energy, namely, 2,200 calories/casting, while the same work in Process II (squeezing by lever) demands only 336.4 cal./casting. The shovelling of sand into the moulding boxes, the setting up of the empty boxes, the removal of the filled boxes, as well as the strickling-off of the excess sand in

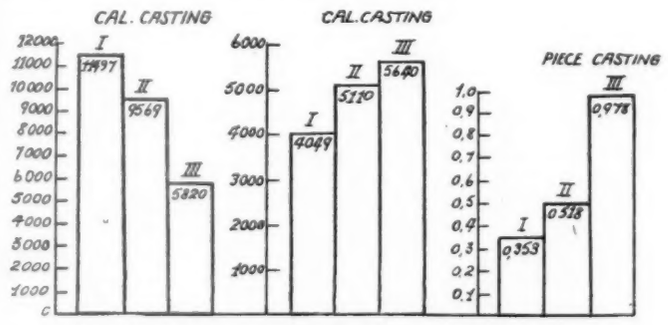


Fig. 2.—Record of the Results of an Experiment in Industrial Physiology on the Moulding Operation.

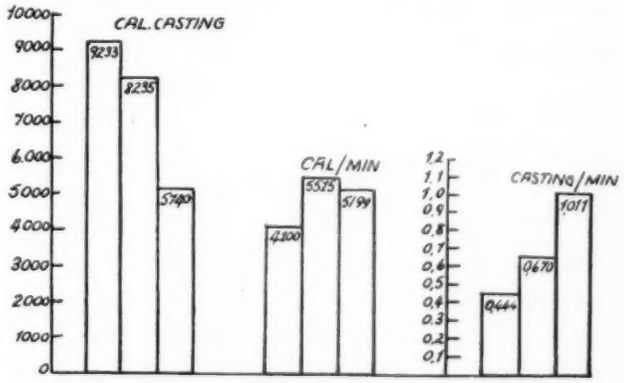


Fig. 3.—Record of Results of an Experiment on the Moulding Operation in which the Provision of the Facing Sand was performed with a Pneumatic Riddling Device.

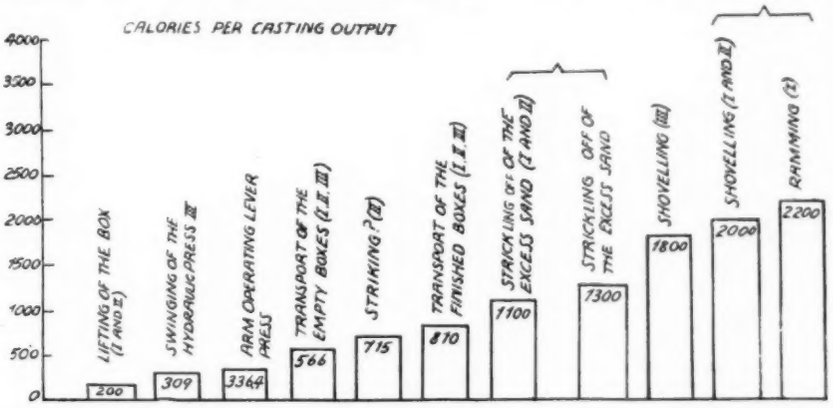


Fig. 4.—Record of Results of an Experiment in Industrial Physiology on the Separate Manipulations in the Moulding Operation.

the filled boxes, require a great amount of energy.

Fig. 5 shows even more clearly what part of the total energy-consumption these separate operations take. It is seen that in the very efficient Process III the subordinate work consumes 76.9 per cent. of the total energy, so that the performance of this auxiliary work by a helper, to the relief of the moulder, is a matter to be considered.

The investigations of Dr. Simonson, who recently became director of the Narkomtrud Institute of Industrial Physiology at Charkoff, in Russia, show that even to-day it is possible to increase the efficiency of the worker by the application of the methods of industrial physiology, without making any greater demand on him than at the periods of lower efficiency. The main requisite is only the elimination of energy-consuming ancillary operations and their replacement with machines.

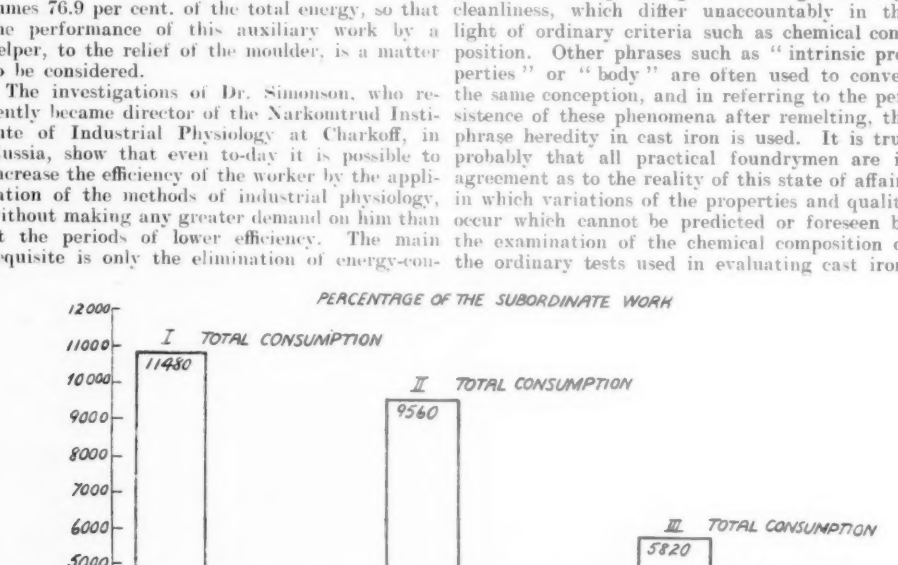


Fig. 5.—Record of the Part of the Total Energy Consumption the Subordinate Work takes in the Moulding Operation.

Book Review.

Sherardising, by G. Petrie and J. C. Mills. Published by Whitehead Bros. (Wolverhampton), Limited, 32, King Street, Wolverhampton. Price 2s. post free.

This little book, of 57 pages, is excellent so far as it goes, but, to our mind, does not go sufficiently far. It does not differentiate, for example between the two sorts of malleable cast iron, and it was only by deduction from the fact that grey cast iron could be Sherardised, confirmed by a letter from the Ewart Chainbelt Company, of Derby, that we felt sure that blackheart was amenable to this treatment. Moreover, only one photomicrograph, of unstated magnification, is reproduced. We should like to have seen a series to show the alloying conditions, with a range of materials. The book, whilst showing that the authors and enthusiasts for Sherardising, contains no advertising matter and is devoid of exaggerations. It definitely fulfils a want, as many times during the past few years we have been asked for details of the process. Yet until definite times and temperatures, correlated with mass or material, are available in book-form, we suppose we shall still receive demands for information. We sincerely hope the next edition will make this sort of information available. This type of metallurgical development—the inducing of an alloy with the surface of everyday materials of construction is one showing much promise, and every contribution to the dissemination of knowledge germane to it, will be appreciated by those desirous of keeping in the forefront of engineering progress. On these grounds the book is specially welcome.

Inherent Properties of Cast Iron.

The phrase inherent properties of cast iron is used in a very broad sense to cover all those properties including strength, shrinkage, fluidity, cleanliness, which differ unaccountably in the light of ordinary criteria such as chemical composition. Other phrases such as "intrinsic properties" or "body" are often used to convey the same conception, and in referring to the persistence of these phenomena after remelting, the phrase heredity in cast iron is used. It is true probably that all practical foundrymen are in agreement as to the reality of this state of affairs in which variations of the properties and quality occur which cannot be predicted or foreseen by the examination of the chemical composition or the ordinary tests used in evaluating cast iron. There are those who are not agreed that such a state of affairs has any existence in fact and claim with equal persistence that the chemical composition is all sufficient as a criterion of the quality of cast iron. The majority of those who hold this latter view are probably the metallurgical and chemical gentlemen associated with the industry. It is clearly obvious that the correctness or otherwise of the real existence of such inherent properties is a matter of profound industrial and commercial importance, and the situation is one which awaits the clearly-defined pronouncement of a responsible and accredited authority. Such a pronouncement would do much to clear away the many misapprehensions which surround this matter at the present time.

It is of great interest in this connection to comment on an article which appears in a recent issue in a contemporary and which refers to the hardenability of tool steels. The writer, Mr. B. F. Shepherd, is the Chief Metallurgist to the Ingersoll-Rand Company of America, and his article is concerned with the existence in tool steels of what is described as "personality," "body" or "timbre," and with a method of determining the relative value of these properties in a form suitable for quantitative expression. It is clearly admitted that such properties exist in tool steels, and in fact goes so far as to attribute the great confusion in existing data relating to steels to this cause. It is shown that different steels of the same composition show different degrees of hardenability under heat-treatment, and this is used to determine a hardenability number which expresses the relative "timbre" of the steels examined. Examples are given culled from a variety of steels which clearly demonstrate the existence of this quality difference. In addition to this extensive experience has shown that steel from different manufacturers will show differences in the distinctness of the border line after hardening and etching between the hardened surface and the core. The article concludes with an appeal for the development of tests to determine such "timbre" and emphasises the industrial value of such tests in that "the purchase of tool steel with timbre as one of the main criteria of selection will result in an improved product, a culling out of undesirable sources of supply and a better understanding of this peculiar quality of steels." The parallel nature of this timbre of steel with the inherent properties of cast iron under discussion will be recognised at once, and whilst mere argument by analogy cannot replace experimental verification such examples do afford home support to those who hold similar views in connection with cast iron.

The properties which come within the ambit of our title are widely varied in character and include practically every aspect of the material both during manufacture and in its finished condition. This makes the whole subject one of great difficulty in experimental verification. It does seem, however, that if the existence of inherent or intrinsic variation in one particular property can be established experimentally, then there are good grounds for assuming that the existence of inherent properties in general is more than a matter of mere rumour. In so far as pig-iron is concerned we published the results of a comparative study of their strength properties undertaken by Mr. J. E. Hurst some few months ago. These results clearly demonstrated that the properties of toughness, stiffness and deformability in a series of pig-irons varied in such a manner as to render the chemical composition useless as a means of predicting these properties. The concept of toughness particularly is closely related to the foundryman's practical experience in breaking iron and as such is probably amongst those properties which are frequently referred to as immeasurable and described as inherent or intrinsic properties. This experimental verification of this aspect of the subject lends ample support to the truth of the view that inherent properties are no figment of the untutored imagination of the practical moulder. As in the case of steel this matter is one of great industrial importance and further enlightened and vigorous experiment is desirable with the object of clearing away the veil of mystery surrounding this matter. We commend this subject to those interested in cast iron and desirous of elucidating its mysteries by investigation.

The Openshaw Foundry of Joseph Stubbs, Limited.

(*Concluded from page* 93.)

Here they are maintained at red heat for 24 hrs. and allowed to cool slowly in the furnace. Typical castings made for the chemical industry are shown in Figs. 11 and 12 are fully machined and completely erected for the work they are intended for.

Patternmaking and Other Departments.

This shop is combined with the joinery department. It is mainly concerned with the alteration of customers' patterns and their mounting on plates for rapid production, and the making of master patterns; generally speaking, then, it is a service department for customers. It will be noted that we have said but little about the sand preparation, as this, at the moment, is largely decentralised. Facing sand is prepared in an edge runner mill, and backing sand is made on the job by means of portable electric riddles. The foundry, in general, is characterised by paying all possible attention in giving the best service to its customers by supplying accurately-dimensioned castings of exceptional softness. Their policy is gradually to extend their manufacturing facilities with a view to effecting economies, whilst still maintaining their high standard of service.

Nickel in Steel Castings.

By F. Johnstone Taylor.

There is probably no more difficult material to deal with in engineering than cast steel. Its main purpose is to provide a light, strong casting, but there is just that element of unreliability and the possibility of some hidden flaw in them that renders even the best steel castings subject to suspicion, and especially is this the case when the pattern is in any way intricate. The addition of nickel to steel castings is just as beneficial as it is to certain grades of cast iron, and it has done much to improve this useful but troublesome material. It improves the toughness as evident from the ductility and impact values, it refines the grain and it causes the material to respond more readily and effectively to heat-treatment which, in itself, improves it too. Not only are better mechanical properties obtained, but owing to the greater penetration of the effects of heat-treatment, they are maintained with greater uniformity throughout both thick and thin sections, while practical founders agree that it improves the castings from the foundry standpoint.

This is quite in accord with modern metallurgical practice because nickel has long been the principal alloy of high-tensile steels both of the structural and machining varieties. Nickel-chrome cast steel has shown a remarkable resistance to shock when used for armour plating and gun shields, but for comparatively intricate castings its value was first demonstrated when the Canadian Pacific Railway successfully cast locomotive frames from 2 per cent. nickel steel. These frames, which are heated to 1,800 deg. Fah. and soaked for 2 hr. per inch of cross section and then cooled in air, have shown on an average of 2,650 tests a yield point of 22¼ tons a maximum stress of 36.3 tons and elongation of 30.3 per cent. and a reduction of area of 61.2 per cent., the steel containing 0.14 per cent. carbon and 0.69 per cent. manganese in addition to the aforementioned 2 per cent. of nickel. The manganese content is kept purposely low so as to facilitate welding and to avoid any tendency to local hardening.

Composition Strength Results in Service.

According to the Mond Nickel Company, a somewhat higher percentage of nickel is deemed advantageous for lighter parts; 2.75 per cent. added to steel with 0.32 per cent. carbon and 0.45 per cent. manganese is suitable for ships' propellers, while 3 per cent. added to 0.3 per cent. carbon steel with 0.7 per cent. manganese has been successfully used for riveted frames by enabling them to be made lighter and less susceptible to stretch. A rather interesting point lies in the strength of this material at low temperatures, that was taken into account when it was used for the locomotive frames, and it is on Norwegian whalers and other ships operating in northern latitudes that nickel-steel propellers have proved their worth.

In regard to comparatively light parts, Tangyes have used it for their Diesel engine connecting rods in place of the more usual forging. In this case the nickel content is 1½ per cent., while 1 per cent. of nickel is deemed suitable for high-pressure valve bodies such as those required to stand up to 4,000 lbs. or so oil pressure as cast by the North British Steel Foundry for Messrs. Glenfield & Kennedy. This material, with 1 per cent. manganese and 0.32 per cent. carbon, has a maximum stress of 43.2 tons, elongation 20 per cent. and reduction of area 33 per cent. In addition to giving added strength and toughness, nickel in steel castings exerts a beneficial effect in maintaining resistance to abrasion, and it imparts an appreciable measure of ductility. In the construction of cement-making machinery, where the duty of any moving parts is obviously severe, both gear wheels and tyres have been made from castings of nickel-chrome-molybdenum steel weighing up to 2½ tons. In this case there is 3 per cent. of nickel with 0.3 per cent. of carbon and molybdenum, 0.7 per cent. manganese and 0.8 per cent. chromium. This material showed an ultimate strength of 61 tons, yielding at 52. It stands up exceedingly well to both shock and wear.

In the case of cutters, four core-cutter heads used in oil drilling are made from heat-treated steel castings with 1.0 per cent., 1.5 per cent. nickel, with half that amount of chromium. With the cutting edges faced with Stellite, they can cut 5½-in. holes and ream up to 17½ in. When furnished with a high-pressure slush, they will cut long cores in wells several thousand feet deep. Perhaps the most severe service met with from the wear point of view is that on the buckets, tines and cutters of excavators and dredgers which are virtually being ground away all the time and in place of employing the more usual built-up construction with renewable wearing parts it can well prove cheaper to cast the whole in nickel steel and on the Ruston Bucyrus excavator the rack and pinion are also of cast-nickel steel.

Heat-Treatment.

Heat-treatment is essential, but any ordinary normalising process will produce the required properties in nickel-steel castings, though for very large ones, there should be a first annealing. This is in the nature of "homogenising," and it is carried out at a temperature considerably above the critical range. Its purpose is to break up the heterogeneous "as cast" structure. A suitable temperature must be selected to suit the actual composition of the material and the thickness of section. The casting is then cooled, and in order to refine the grain it is normalised by air-cooling from a temperature just above the critical range. This, if the casting is highly alloyed or in any way complicated, is followed by tempering at about 600 deg. C. In the case of the usual 2.0 per cent. nickel addition to 0.3-0.4 carbon steel the effects of heat-treatment as given by the Mond Nickel Company as listed below:—

Treatment.	Yield point. Tons per sq. in.	Maximum stress. Tons per sq. in.	Elongation. Per cent.	Reduction of Area. Per cent.	Bend test. Radius—1T	Charpy impact value. Kgm. per sq. mm.
As-cast	24.1–27.3	31.8–34.3	3–5	2–4	—	1–2
Annealed for 3 hrs. at 850 deg. C...	24.1–27.3	31.8–35.0	15–22	25–35	90 deg–110 deg.	4–6
Complete heat-treatment	25.4–43.1	41.3–54.0	15–30	40–65	180 deg. Unbroken	9–15

It is claimed that a suitably combined homogenising, air-quenching and tempering treatment gives a nickel-steel casting all the properties of a first-class forging, which, after all, is what is looked for by the user.

Messrs. Hadfields, who make something of a speciality of the wearing parts of bucket dredgers, excavators, etc., form the buckets and tray castings of nickel-chrome steel with renewable lips of "Era" manganese steel. For the tumbler itself, of the most up-to-date built-up type, the renewable wearing plates which take the brunt of the hammering from the buckets can also with advantage be made as nickel-chrome steel castings, these being held to the body of the tumbler by bolts of similar steel.

An acid-proof jointing material can be made from asbestos string soaked in silicate of soda.

Publication Received.

The July issue of the **Bulletin of the Association Technique de Fonderie** has assumed the rôle of Official Guide and Handbook for next month's International Assembly to be held in Paris on September 13 to 18. Maps are included, showing the routes to be undertaken by those participating in the pre- and post-convention tours. The portraits of all the personalities connected with the Association are reproduced, and the patrons, included amongst whom is virtually the whole of the French Cabinet, whilst the committee of patrons—a different body—presided over by Mr. Dufour, is equally imposing. Pages 9 to 33 are devoted to detailing the itineraries and general programme and to illustrating the interior of the works, the picturesque places visited and some of the historic and artistic buildings included in the various tours. Unfortunately, the quality of paper used is not such as to allow the printer to get the best out of the blocks he has used. On page 37 there is a list of the Papers to be submitted, and their authors and titles were printed in our last issue. We note that some of the Papers are credited more to the firm than the authors. This is the second occasion on which we have noted this, and the innovation does not have our sympathy. The list on page 38 of international foundry congresses shows that since 1926 they have been held annually. In addition, there have been two German ones, which were well worthy of ranking as international manifestations, as they were more important than most of those appearing on the list. It was an excellent notion to print this, as it gives much food for thought. Then follows the history of the Association, and like most it was created by the technical Press. It is followed by the story of the creation and development of the Syndicat Général des Fondeurs de France—the employers' federation, which boasts of a thousand members. This body was responsible for the creation of the Paris Foundry Training College, to which six pages are devoted. On page 50 two other organisations are passed in review. One, the Chambre Syndicale des Fondeurs en Cuivre et Bronze de la région Parisienne, was founded in 1445. The other is the Association Amicale et Mutuelle de Fonderie—a society similar in character to the "Foremen's Benefit." Before the Bulletin takes its normal aspect, there are just two other features. A sort of post-graduate course, organised by the Union des Industries Métalliques et Minières, and the competitions for practical men to be held in connection with the exhibition. We understand that Mr. T. Makemson, the Secretary of the Institute of British Foundrymen has a quantity of this issue of the Bulletin for distribution amongst those who are considering the participation in the forthcoming congress.

High-Sulphur Nitralloy Steels.—By a comparative investigation of two nitralloy steels, one high in sulphur and one low, Dr. V. O. Homerberg, Associate Professor of Physical Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass., demonstrates by suitable tests that a high-sulphur nitriding steel of the aluminium-chromium-molybdenum type can be used to advantage whenever free machining is necessary and maximum impact properties are not essential.—"The Iron Age."

Foundry Blacking.

A method for testing permeability and strength of foundry blacking has been evolved by E. Feil.* The apparatus used for preparing the test specimen is shown in Fig. 1, and consists of a round filtering vessel, *a*, about 100 mm. in height, a fitting cylinder, *b*, of 50 mm. inside diam., and a filter plate, *c*, of the same diameter. The specimen is prepared in the following manner: after assembling the apparatus, a filter paper is placed on the plate, and is wetted and sucked up. The blacking mixture is then poured on the filter and the whole apparatus gently shaken in order to distribute the mixture evenly over the whole cross-section. The water is then carefully decanted off until the surface of the blacking just becomes dry. The plate with the cake is taken out and dried at 110 deg. C. for two hours, and after cooling the filter is removed from the cake by means of a pincette. For testing, the blacking cake is placed filter side down, in a steel cylinder of 50 mm. inside diam., shown at *a* in Fig. 2, at the inside of which a steel ring, *b*, of 30 mm. inner diam. is affixed. In order to prevent the fragile test specimen *c*, from being damaged, a rod or tube is first passed through the cylinder; the specimen is placed on, and the cylinder slowly moved upwards until the specimen is seated on the ring. The space between specimen and cylinder is filled with wax, and a small iron ring *d*, of 30 mm. inner diam. is placed on the specimen. The ring is provided with three lateral guide pins to ensure proper seating, whilst a 2-mm. mesh sieve soldered to the ring prevents the test specimen from being broken during testing. The space between the ring and steel cylinder is then filled up with wax, and air is pressed through the cylinder and the test specimen. From the dimensions of the specimen and the time taken for a litre of air to pass through it, permeability is computed by means of the following formula:—

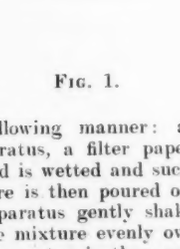


Fig. 1.

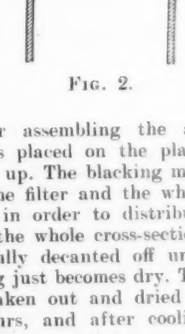


Fig. 2.

$$\frac{\text{1,000 c.c. of air} \times \text{height of specimen in mm.}}{\text{time in min.} \times \text{pressure in cm. mercury gauge} \times \text{cross-section of specimen in mm}^2}$$

or, as the cross-section is constant,

$$\frac{\text{1,415} \times \text{height of specimen in mm.}}{\text{time in min.} \times \text{pressure in cm. Hg gauge}}$$

The apparatus used for determining the transverse strength of the blacking is shown in Fig. 3. A rectangular test-specimen, prepared in the same way as described above, is placed on the two supports *f*, and the bail *a* is carefully moved over the specimen up to the centre marked by the pointer *c*. To the bail the small celluloid basket *d* is suspended, the bottom of which is stuffed with wadding. Small shot is then fired into the basket until the specimen breaks.

The following blacking mixtures were tested:—

Experiment No.	Mixture No.	Composition, per cent.				
		Plumbago, under 0.1 mm.	Ground crucible material grain size			Coke dust under 0.1 mm.
			Under 0.1 mm.	0.1 to 0.2 mm.	0.2 to 0.6 mm.	
A	1	100	—	—	—	—
	2	80	20	—	—	—
	3	60	40	—	—	—
	4	40	60	—	—	—
B	5	80	—	20	—	—
	6	60	—	40	—	—
C	7	80	—	—	20	—
	8	60	—	—	40	—
D	9	80	—	—	—	20
	10	60	—	—	—	40
	11	40	—	—	—	60
E	12	100	—	—	—	—

For the permeability test 10 grams of the mixtures recorded in the table were well mixed with 20 c.c. of water and allowed to stand for 24 hrs. The specimens were then prepared and tested. The samples for the strength test were made from 15 grams of the mixture and 30 c.c. of water; whilst in mixture No. 12 sour beer was used instead of water.

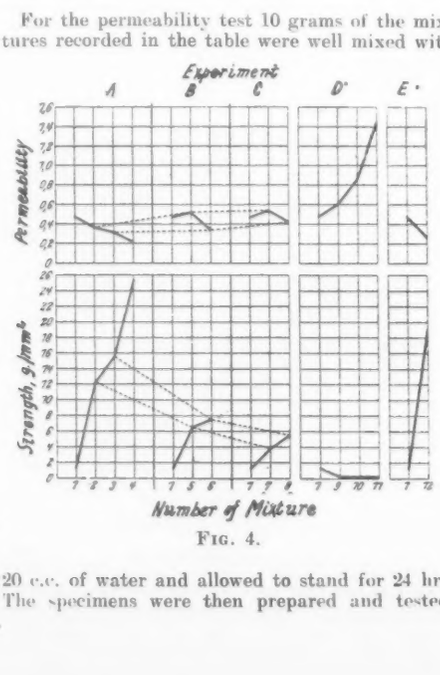


Fig. 4.

An X-ray inspection of the specimens prior to testing showed that shaking the apparatus during preparation of the specimens had not caused disintegration of the mixtures, and, further, that the larger grains of the crucible material had not decomposed in mixing with water or during standing. Further, it showed that the small iron and slag particles present in the ground plumbago crucible material were evenly distributed over the whole cross-section of the specimens.

The test results are illustrated in Fig. 4. Experiment A shows that permeability of a blacking mixture decreases with increasing content of crucible material of a grain size under 0.1 mm. This means that the latter still possesses some bonding material which strengthens the blacking. By adding crucible material of a larger grain size (Experiments B and C), permeability is somewhat increased with a content of 20 per cent., and decreased below the original value with a content of 40 per cent.; further, by adding coke dust permeability is increased in proportion to the amount actually present (Experiment D). Sour beer decreases permeability considerably (Experiment E). The dotted lines in the graph show that, with the same percentage of the additional material, permeability is increased with increasing size of the grain. When computed from the formula given in the American Specification, permeability of the mixtures investigated is equal to about 75 per cent. of the values given in the graph. Fig. 4 further shows that the transverse strength of a blacking mixture is increased with increasing content of crucible material (Experiments A, B and C), whilst with the same percentage of the additional material it is decreased with the larger sized grain (dotted lines). The strength decreases to nil when coke dust is added, but increases considerably with sour beer.

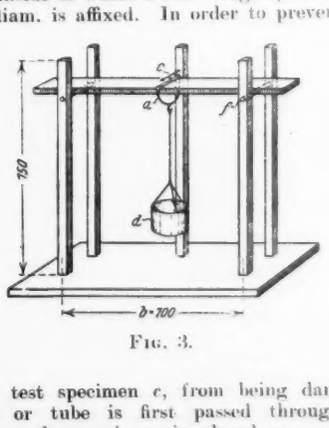


Fig. 3.

* "Die Giesserei," 1932, pages 41-46.

Salient Points of American Steel Founding.

(*Concluded from page* 96.)

man, he could hardly have developed this belief, had he not believed the expenditure of time worth while. The result of this has been a very large growth of the association movement, of both commercial and technical type. In each case the associations are extremely active, attendances are large, and the programmes both ambitious and progressive. The value of any trade or technical association, and its possibility of growth and activity, is in direct proportion to the degree of interest evinced by the membership, and attendance at a number of association meetings in this country has impressed the writer with the possibilities made available by a full and impartial discussion, and an unrestricted interchange of ideas. The feeling of industrial fellowship engendered by these associations shows itself definitely in the willingness shown by manufacturers to welcome their competitor's representatives at their plant.

It can be said with truth that any accredited representative of a steel foundry will receive a welcome at the plant of his competitor, in this country. It is recognised that one gains equally as much as is given, by such a procedure. As a result, the steel-casting industry in the United States tends to progress as a whole, to the ultimate benefit of the entire industry, as an outcome of higher standards of attainment. A Paper of this type must be necessarily somewhat sketchy, if it is not to be unduly prolonged, and the author would apologise for any shortage of detail of a technical type, in certain sections. To present a general view of the industry as it strikes a European has been the object, rather than labouring at technical processes or controversies, which are more suited to a purely technical article.

Copper Turns the Corner.

From a Correspondent.

After a fall prolonged beyond the lowest limits ever conceived to be possible by those who have spent a lifetime studying the vagaries of the metal markets, copper suddenly made up its mind just before the August bank holiday to turn on its track and bolt in the most thorough-paced fashion. As usually happens on these occasions, no warning whatever was given of this impending change of front, for all the bear points which have been instrumental in forcing the quotation for this metal down to the lowest point ever touched in its history were still present. They are still for that matter, but a notable change has been wrought in the mentality of potential buyers, for they have received a rough reminder that a fall in the value of any commodity cannot go on for ever.

In the States, thanks to the application of the 4 cent duty, the fall was not so severe as in Europe, but even so values broke 5 cents, though not to the extent of coming down to 4.60, which was the level at which consumers in the Old World were able to buy their copper just before the turn. In this desperate scramble for business at any price Japan was the leader, with Canada not far behind, but the actual tonnage cleaned up by buyers at this distress price was not big, and once the turn came values were hoisted daily while the tonnage available was not any too large. Although France and Germany bought freely, the speed and extent of the advance (25 per cent. in ten days!) would have been much more limited if consumptive buying, and that only, had been responsible for the movement. Once again, however, the speculator has jumped in, and, for the comfort of the producer and to the embarrassment of the consumer, has raised values at lightning speed. Weekly turnovers in standard warrants ran into a tonnage of four figures, and brokers have netted quite a useful sum in commission on clients' business.

Copper was, of course, ripe for a rise, the fall having been sadly overdone in spite of huge stocks, poor demand and uncertainties set up by tariff discussions. The big bull movement on Wall Street gave it a start, while advancing values of other commodities, such as cotton, grain and tin, all helped to foster the belief that at long last the "worm had turned." At the time of writing the red metal has climbed back to 5½ cents, and in spite of a reaction on Wall Street and an easing up of buying power looks like consolidating the gain achieved. There is undoubtedly more confidence among business men, but a good deal of uncertainty as to whether the rise in copper has really spent itself, for in many quarters it is held that 6½ cents can and will be achieved before the end of August. Though bulls may be a little unsure of themselves, bears feel even more unsettled in their policy and it is very doubtful whether they will risk selling short at the present juncture. Should a further rise accrue and the swing of the pendulum be unduly accelerated, then in all probability the market will again become vulnerable and we shall see a reaction.

Unfortunate as it may be from the viewpoint of the consumer, whose lack of experience does not allow him to hedge his position on the standard market, there is little or no likelihood of real stability in the red metal for some time to come. Copper, it is believed by the writer, has embarked upon an upward movement, but this will be chequered, and bearing in mind that this metal has always been a favourite gambling counter, it is obvious that ups and downs are going to be frequent. For all that, there is a golden rule for every metal buyer which says, "Operate on every fall," and as long as the price of copper keeps below 7 cents it is difficult to see how this advice can prove to be otherwise than sound in its application to the situation we have to face.

Science in Foundry Sundries.

PARTING POWDERS.

By Works Chemist.

The wise choice of foundry supplies will often make the difference between profit and loss on the working of the foundry. Sundries, such as parting powders, dusting powders, core compounds, pattern compounds and the like, have only one *raison d'être* and that is, to produce better castings at, if possible, a cheaper rate and a greater speed. Parting powder is a typical instance. The old-fashioned parting powder was well-burnt sand, and, perhaps, as an added refinement a good barrelling with a proportion of resin. Sometimes coke dust was used instead of burnt sand. A well-burnt brick, pounded to dust, was also used, and in quite a number of foundries these old-fashioned partings are still used.

From a scientific standpoint they leave something to be desired, however, being productive, very often, of rough-surfaced castings. In some cases, these rough and ready partings do not part at all, if the mould is left closed for some time, nor are they of much use when deep lifts are necessary. Yet, again, as a class, they did not keep the patterns dry, because they were not waterproof, so that the dampness from the sand made the patterns moist, thus requiring occasional warming to dry them.

Requirements of a Perfect Parting Powder.

Parting powder should be light in colour, finely ground and smooth in texture, waterproof, of hugh-fusing point and must be of sufficient weight to sink down on to the pattern instead of floating in the air and being wasted. Also it must be low in price. A survey of the available materials indicates that silica in some form is the most likely material, although it is not waterproof. It is light in colour and is neither too heavy nor too light, whilst it will not form a fusible compound with the moulding sand—as, for example, lime or magnesia might do.

The difficulty of the lack of waterproofing can be overcome by melting into the finely-ground silica a hard wax or mixture of wax and resin. A soft wax is useless, since it produces a powder very liable to clog together in the sifting bag. Merely grinding the wax and silica together is by no means so good as actually heating the silica up to the point at which the wax melts, thoroughly impregnating the entire mass.

As regards the silica, it is not every form of this mineral which is satisfactory. A smooth texture is a primary requirement, and, actually, there are few siliceous materials which fulfil it. Probably the best mineral is Tripoli, which is supposed to be—although doubts have been cast upon the origin—a siliceous limestone from which the limestone has been dissolved. Thus every portion, even to the small particles remaining after fine grinding, is porous and friable, whereas ground quartz, flint or sand is always solid, hard and generally in sharp particles, no matter how finely ground. Kieselguhr or diatomaceous earth, consisting of the siliceous skeletons of diatoms, is also of a similar porous nature.

When waterproofed the porosity is filled up with the melted wax and produces a very good parting powder indeed. There are unfortunately no deposits of Tripoli in this country, but there are other deposits having a somewhat similar nature which produce very good parting powders at a very low cost for raw materials. Clays and other colloidal substances, although of fine texture, are unsuitable, since they require large amounts of wax to become thoroughly waterproof.

After waterproofing it is found that some of the material becomes clogged together, and so it is necessary to grind or disintegrate the product until it will all pass through the pores of a sifting or dusting bag. Care is necessary to see that the material is not heated up during grinding sufficient to melt the wax again or even to soften it unduly. Actually it is not a grinding operation proper but merely a disintegrating effect that is required.

The finished parting powder is then waterproof, light coloured, sufficiently heavy, smooth in texture, will not fuse with the heat of the metal, and in practice keeps the patterns in thoroughly dry condition so that continuous working is possible, whilst deep lifts become considerably easier to draw off in perfect condition. It is not too much to say that for success in machine-moulding a really good waterproof parting powder is essential.

District Presidents.—No. 1.

SCOTTISH BRANCH OF THE INSTITUTE OF BRITISH FOUNDRYMEN.

Mr. H. Dudley Campbell, the new President of the Scottish Branch, was born in Glasgow. He served an apprenticeship in mechanical engineering in the shops of the Caledonian Railway works at St. Rollox, Glasgow, and afterwards changed to marine engineering, spending five years at sea and obtained the Chief Engineer's

Mr. H. Dudley Campbell.

Chairman of the Scottish Branch of the Institute of British Foundrymen.

Certificate. Later Mr. Campbell took up electrical work and was connected with the firm of Messrs. Laurence Scott & Company, Limited, Norwich, for about seven years. In 1912 he entered the service of Messrs. Shaw (Glasgow), Limited, Maryhill Iron Works, Glasgow, as works engineer for the purpose of carrying out alterations and modernising of the plant and large extensions to the works. He became a director of the firm in 1917. Mr. Campbell became a member of the Institute of British Foundrymen in 1927, and immediately took an active part in the work of the Scottish Branch, especially in connection with any scheme for assisting the younger members. He has served as councillor, junior and senior Vice-President of the Branch in a manner which suggests that during his term as President the work of the Scottish Branch will continue to increase in usefulness to its members and of the foundry industry. Mr. Campbell is also a prominent member of the Institution of Engineers and Shipbuilders in Scotland, which he joined in 1908, one of the kindred Institutes with which the Scottish Branch works in close co-operation.

XUM

This Week's News in Brief.

Trade Talk.

Details have been placed with the Registrar of Companies of a reduction in the capital of the Barrow Hematite Steel Company, Limited, from £916,965 to £104,465.

The London Midland & Scottish Railway Company, Limited, announce with great regret that their steelworks at Crewe will be closed on September 30. The employees have been given notice.

The White Star liner "Laurentic" will sail for Montreal from Liverpool on September 2 with a representative exhibition of British goods and a legion of expert salesmen. The ship will remain at Montreal for a week.

Messrs. Dorman, Long & Company, Middlesbrough, have received a contract from the Toronto Transportation Commission for 600 tons of electric railway rails. This is said to be the first order of its kind received in this country from Toronto during the last 40 years. This firm has also secured contracts from the L.M.S.R. for the construction of three small bridges.

British firms have received contracts from the Chinese Government for the supply of railway material valued at about £100,000. The firms mentioned in this connection are Messrs. Dorman, Long & Company, Limited, Barrow Hematite Steel Company, Limited, the British (Guest, Keen, Baldwins) Iron & Steel Company, Limited, and the Lancashire Steel Corporation, Limited.

We are informed that the Société des Etablissement A. Utard, whose products are marketed in this country by the Ealing Park Foundry, Limited, Junction Road, South Ealing, London, W.5, are exhibiting at the forthcoming International Foundry Exhibition at Paris in September, and a cordial welcome will be given all those visiting their stand, where a wide range of moulding sands, sand mills and foundry equipment can be inspected.

We understand that Messrs. Beyer, Peacock & Company, the locomotive engineers, have recently purchased from the receiver of the Agricultural & General Engineers the works and business of Messrs. Richard Garrett & Sons, of Leiston, Suffolk. The directors propose carrying on at the Leiston works, originally established in 1778, the business of general engineers under the title of Richard Garrett Engineering Works, branch of Beyer, Peacock & Company. No fresh issue of capital is at present involved.

Between now and next March a number of Admiralty contracts are expected to be placed. These will be very considerable, as a result, it is said, of overlapping of the naval programmes since 1930. The two programmes together provide for four 7,000-ton Leander cruisers, two 5,500-ton Arethusa cruisers, two flotilla leaders and sixteen destroyers, eight sloops, six submarines, two gunboats and three depôt or auxiliary ships. It is said to be the Admiralty's intention to spread this work as much as possible.

The old-established engineering firm of William Whiteley & Sons, Limited, Prospect Works, Lockwood, Huddersfield, which has been carrying on in liquidation for the past two and quarter years, is now closing down owing to declining business. The works are to be closed immediately existing contracts are finished. It is understood that the works, including the railway siding and motive plant, have been purchased by David Brown & Sons (Huddersfield), Limited, gear cutters, Park Works, and that it is the firm's intention to convert Messrs. Whiteley's foundry to the new system of centrifugal casting.

Messrs. George Richards & Company, Limited, engineers, of Broadheath, Altrincham, who have executed work for Russia during the past 12 months of the value of about £46,000 under the export credit scheme, state that as no further British Government credit is at present available further business cannot be accepted, and work which might otherwise be done at their works is in danger of being lost. The limit to the amount to be guaranteed in any period of six months in respect of exports to Russia has, it is stated, already been reached in the case of the portion allotted to the engineering industry.

Under the terms of an agreement between the Skinningrove Iron Company, Limited, Saltburn-by-the-Sea, and Messrs. Pease & Partners, Limited, the lease under which that company has been operating the undertaking since 1922 has been surrendered, and from now the business will be continued by the Skinningrove Company on its own account, all existing trade contracts being duly carried out by them. Communications relating to sales and deliveries of pig-iron, steel and other products should be addressed to the Skinningrove Iron Company, Limited, Saltburn-by-the-Sea. Messrs. Pease & Partners, Limited, still retain their interest in the company.

Meetings of the British Electric Transformer Company were held this week in London to consider the proposed arrangement with Crompton Parkinson, Limited, and a scheme of reconstruction. In each case the resolutions were approved by large majorities. Under the proposed scheme, the existing preference and ordinary capital of the British Electric Transformer Company will be reduced and converted into one class of preference shares of £1 each, carrying a 5 per cent. cumulative dividend, guaranteed by Crompton Parkinson, Limited, while the latter will hold all the issued ordinary shares as consideration for the transfer to the British Electric Transformer Company of its transformer department.

Protests are being made against the possibility of an end being put to the activities of the Darlington Forge, Limited, following the appointment of a receiver, not only in Darlington, where increased unemployment would follow, but in the shipbuilding districts of the North-East Coast. It is felt that such a course would place shipbuilders on the North-East Coast at a serious disadvantage compared with other areas and increase their difficulties in efforts to secure work, as most of the shipbuilding establishments are able to manufacture small castings in connection with with shipbuilding contracts, but for exceptionally large and heavy castings and forgings they have relied upon the equipment possessed by the Darlington Forge, which was also admirably situated for their needs.

The German concern Rheinische Stahlwerke A.G. of Essen, reports for its past financial year that their surplus for the year, with the amount brought forward from the previous year and a sum of 30.31 million Rmks. taken from the reserve fund, represents a total sum of 41.78 million Rmks. There will be no dividend but the whole of the amount will be written off for depreciation in plant, in the value of the concern's own shares and the shares and securities held in affiliated concerns. The gross profits of the collieries only amounted to about 4 million Rmks. (compared with 8 millions and 13 millions respectively in 1930 and 1929) showing the shrinkage in fuel consumption, and the consequent falling off in the output of coal and coke. But while the outputs declined by about 20 to 25 per cent. compared with the previous year, gross profits fell off by about 50 per cent., due to the fall in prices in the Ruhr district.

Davey, Paxman & Company (Colchester), Limited.—We learn that this company, which was registered on August 2 to take over the business of Davey, Paxman & Company, Limited, the well-known engineers and boilermakers, is continuing the production of boilers, steam and Diesel engines and other specialities formerly made by their predecessors, in addition to the manufacture of special machinery which has, prior to the introduction of tariffs, been manufactured abroad. The company is under the chairmanship of the Rt. Hon. Viscount Goschen, G.C.S.I., G.C.I.E., C.B.E., with a directorate of men of extensive financial and business experience. Generally speaking, the personnel of the old company will be retained, thereby ensuring absolute continuity of policy, experience, manufacture and service. The active management of the business will be in the hands of Mr. P. A. Sanders, O.B.E., A.M.I.Mech.E., and Mr. E. P. Paxman, M.A., whose long association and intimate knowledge of the old company's products will assure the maintenance of the high standard of quality associated with Paxman manufactures, which have been supplied to all countries throughout the world. It will be remembered that Paxman Diesel engines have recently been installed in the power-houses of the Bank of England and the Prudential Assurance Company, Limited, for the generation of electric light and power. The head office and works will be at Standard Ironworks, Colchester (telephone number, Colchester 3151), whilst their London office will be at Aldwych House, W.C. 2 (telephone number, Holborn 4966).

Personal.

Mr. Joseph Hepworth, M.P., founder director of Hepworth & Grandage, Limited, Bradford, is among the new magistrates who have been added to the Commission of the Peace for Bradford.

Mr. R. F. Scott, of Messrs. Arnott, Young & Company, Limited, of Darlington and Glasgow, has been elected President of the North-East Coast Iron and Steel Merchants' Association, in succession to Mr. R. Cheyne, who has resigned.

Mr. J. Lloyd Bentley has resigned his position as managing director of the Darlington Rustless Steel & Iron Company, Limited, and is vacating his seat on the board, but, it is announced, is to continue in an advisory capacity. Mr. E. K. Mull has been appointed general manager to the company.

Mr. William Taylor Kitching, managing director of John Fowler, Limited, of Sheffield, has been appointed general manager of the Ironworks Department of Newton, Chambers & Company, Limited, Thorncliffe, near Sheffield. Mr. Kitching was educated at Oundle, served his engineering apprenticeship with the Horsehay Company, and has had a wide experience in engineering.

Wills.

Gameson, Arthur, Colwyn Bay, malleable ironfounder and tinner	£14,928
Bicknell, John, of Bristol, secretary and managing director of the Bristol & South Wales Railway Waggon Company, Limited	£14,626

Obituary.

Mr. Frederick Harcourt Kitchin, formerly editor of the "Board of Trade Journal," died on Saturday last at Lee-on-Solent at the age of 64.

Company Reports.

Parkinson & Cowan, Limited.—Profit, £1,122; brought in, £7,974; from reserve, £15,000; carried forward, after payment of preference dividend for the half-year to September 30, 1931, £7,159.

Marshall, Sons & Company, Limited.—The directors have issued a statement giving the trading results for the first six months of the current financial year. It shows a profit of £16,650, and, after deducting the half year's debenture interest (7,798), a net balance of £8,852 is given. The adverse balance brought into the current year amounted to £84,057.

Cowans, Sheldon & Company, Limited.—Net profit for the year ended June 30, £23,907 (against £24,311 for 1930-31). It is proposed to maintain the dividend for the year at 10 per cent., to place £5,000, as last year, to dividend equalisation reserve, and to allocate £1,300 to recreation club for pavilion and equipment. The amount to be carried forward will then be increased from £53,266 to £55,873.

New Companies.

Blomfield Engineering Company, Limited, Finsbury House, Blomfield Street, London, E.C.—Capital £2,000.

Dalatem, Limited.—Capital £10,500. Metal-alloy producers. Solicitors: McCloughin & Lake, 69 and 70, Piccadilly, London, W.

Birmingham Crucible Company, Limited, 1, Broad Street Place, London, E.C.—Capital £7,000. Directors: H. C. and R. A. Mant, B. J. Allison.

W. H. Stone & Company (Cardiff), Limited.—Capital £2,000. Engineers' agents, etc. Director: W. H. Stone, "Linton," Rhiwbina, nr. Cardiff.

Sulzer Bros. (London), Limited, 31, Bedford Square, London, W.C.—Capital £50,000. Engineers. Directors: H. and R. Sulzer, H. L. Wolfer, F. Oederlin, J. F. Schubeler and W. T. Batho.

Cast Red Brass.—The results of an extensive research undertaken by H. B. Gardner and C. M. Seager, junr., who are both associated with the U.S. Bureau of Standards, upon factors affecting the physical properties of cast red brass (85 Cu, 5 Zn, 5 Sn and 5 Pb) were disclosed to the 35th meeting of the American Society for Testing Materials.

XUM

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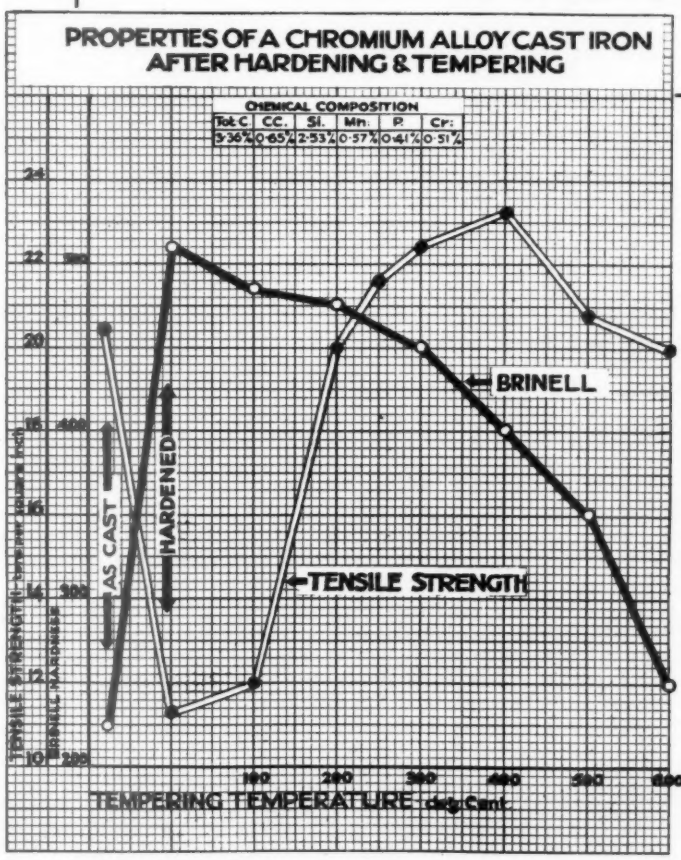
NICKEL & CHROMIUM FOR HARDENING


PROPERTIES OF A CHROMIUM ALLOY CAST IRON AFTER HARDENING & TEMPERING
CHEMICAL COMPOSITION
Tot C 3·36% CC. 0·65% Si. 2·53% Mn. 0·57% P 0·41% Cr. 0·51%
BRINELL
TENSILE STRENGTH
AS CAST
HARDENED
TEMPERING TEMPERATURE deg Cent

FOR the production of Chromium or Nickel-Chromium Air Hardening or Oil Hardening Cast Irons, Bradleys have a wide range of Refined Chromium Alloy Pig Irons (with or without Nickel).

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Raw Material Markets.

There has been no fresh development in the iron and steel markets this week, business in general remaining limited. Whether the arrival of autumn will bring any revival in trade cannot be prophesied with any certainty, but the prospect of increased overseas markets for iron and steel resulting from the Ottawa Conference affords a reasonable opportunity for optimism. The home markets are very slow at the moment, and do not seem to have recovered from their holiday lassitude.

Pig-Iron.

MIDDLESBROUGH.—The local market is temporarily disorganised by the holidays, which began last week-end and are in some cases being protracted to a fortnight. There has, however, been an increase in inquiry from other areas, particularly from Scotland, where pig-iron production has been further reduced, and a slight increase in activity at the Cleveland furnaces may be witnessed at the resumption of work. The fixed minimum quotations are:—No. 1 Cleveland foundry iron, 61s. per ton; No. 3 Cleveland G.M.B., 58s. 6d.; No. 4 foundry, 57s. 6d.; No. 4 forge, 57s. per ton, f.o.t. or f.o.b. There is virtually no export trade.

The East Coast hematite market is showing a slightly stronger tone. Mixed numbers at 61s. per ton might possibly be bettered in some quarters, but price-cutting is not nearly so general as it was, and makers are looking for better business after the holidays.

LANCASHIRE.—Few new orders for foundry iron are reported. Deliveries into consumption have also fallen off, but this is partly the effect of the holidays. Foundry-iron prices have been fully maintained at 67s. per ton for Midland brands of Derbyshire and Staffordshire No. 3, about the same figure for Cleveland iron, 65s. 6d. for Northamptonshire, about 84s. 6d. for Scottish, and about 81s. for West Coast hematite, all for delivery Manchester or equal distance. Derbyshire forge iron for delivery to Manchester users is on offer on the basis of 62s. per ton. Cheap Indian iron is still readily obtainable at from about 67s. to 77s. per ton, according to quality, and including delivery to local users.

MIDLANDS.—Few ironfounders in this district are willing to enter into contracts at present prices. This applies to both light and heavy castings makers, but the former group are shortly expecting a better demand for domestic castings. At the moment, however, trade is very patchy. The controlled prices of foundry iron are 62s. 6d. for Northants No. 3 and 66s. per ton for Derbyshire, Lincolnshire and North Staffordshire No. 3, including delivery to Birmingham and Black Country stations.

SCOTLAND.—Pig-iron business in this area remains of a trivial character, and there are no signs of improvement, particularly among the shipbuilders, whose requirements form a large proportion of the demand in normal times. The official fixed price of 69s. 6d. for No. 3 Scotch foundry at furnaces remains in force, with a minimum of 2s. 6d. per ton extra for No. 1. A cargo of about 300 tons of West Coast hematite was discharged in Glasgow harbour last week. No. 3 Middlesbrough is quoted at 55s. 6d. per ton f.o.t. Falkirk, with other English irons obtainable at slightly less. There is no Continental foundry being offered, but Indian iron continues to arrive in diminishing quantities

Coke.

Little fresh buying has been observed in the foundry-coke market, the general consumption being limited. The price of Durham coke, either for prompt or deferred despatch, is 37s. 6d. for best grades, with inferior qualities at about 35s. No change is apparent in Welsh coke, the cheapest price being 30s., ranging from this level up to 45s., per ton delivered Birmingham and district.

Steel.

Most of the finished-steel works have now resumed rolling operations, but few have a forward order-book of any length, hand-to-mouth working being the general rule. It seems as if this state of affairs must continue for some time, as few specifications are coming to the structural engineers and shipbuilders. Prices remain unaltered. Several small sales of Continental semis have been negotiated this week, but the market generally remains slow. A very limited trade is being done by the English producers.

Scrap.

Owing to the holidays at the Cleveland foundries, there is little local demand for scrap iron, although more inquiries have been received referring to deliveries a few weeks ahead. Heavy cast iron is at 35s. for ordinary quality. Good machinery quality in handy sizes commands 36s. per ton and light castings 30s. to 31s. per ton. In the Midlands, the cast-iron scrap market is somewhat easier owing to the effect of the holiday season. Heavy machinery in handy sizes is offered at 45s., delivered, heavy pipe and plate at 40s. and clean light at 35s. delivered. In South Wales, heavy cast iron in large pieces and furnace sizes is displaying a little more activity, and is firmer at 40s. to 42s. 6d. The local foundries are not busy, and their demand for good cast-iron machinery scrap in cupola sizes is in consequence weak at 45s. to 47s. 6d., the advance in price being due to the better demand for the heavy material for basic-steel making. In Scotland the foundries are working from hand to mouth, and only purchasing their immediate requirements. Machinery scrap in pieces not exceeding 1 cwt. is at 43s. 6d. to 44s. 6d. per ton, with ordinary cast to the same specification at 39s. to 40s. per ton.

Metals.

Copper.—The price of copper has, of course, been considerably assisted by the easier exchange, but, at the same time, general conditions are thought to be slightly more favourable. Inquiries for autumn delivery have shown an increase, and consumption shows no sign of further recession. Electrolytic has been sold at up to 5.50 cents per lb. c.i.f. Europe, but the quotation is now 5.40 cents.

Closing quotations :—

Cash.—Thursday, £30 7s. 6d. to £30 10s.; Friday, £30 10s. to £30 12s. 6d.; Monday, £30 7s. 6d. to £30 10s.; Tuesday, £30 17s. 6d. to £31; Wednesday, £31 3s. 9d. to £31 5s.

Three Months. — Thursday, £30 10s. to £30 12s. 6d.; Friday, £30 12s. 6d. to £30 15s.; Monday, £30 8s. 9d. to £30 10s.; Tuesday, £31 to £31 1s. 3d.; Wednesday, £31 5s. to £31 6s. 3d.

Tin.—This metal continues to hold its improved position. The improvement is due mainly to the continued professional buying of any loose parcels, backed by the cessation of supplies from the mines. However, doubts are being expressed as to the real stability of the market, especially so in view of the fact that the consuming industries in the U.S.A. and on the Continent continue to make a poor showing. It seems improbable that the present value can be maintained, but the two months' "export" holiday" has at any rate helped to clear away the stocks of cheap metal that were depressing the market.

Official closing prices :—

Cash.—Thursday, £142 to £142 5s.; Friday, £142 10s. to £142 15s.; Monday, £142 5s. to £142 10s.; Tuesday, £143 7s. 6d. to £143 10s.; Wednesday, £142 15s. to £142 17s. 6d.

Three Months.—Thursday, £143 10s. to £143 15s.; Friday, £144 to £144 5s.; Monday, £144 to £144 2s. 6d.; Tuesday, £145 to £145 2s. 6d.; Wednesday, £144 5s. to £144 7s. 6d.

Spelter.—Consumers in this country have been buying slightly more metal lately, but the general position of the spelter-consuming industries leaves much to be desired, so that the recent rise in prices must be attributed to the general buoyancy of sentiment on the Metal Exchange. The fact that the international producers' association continues to report decreases in its stocks, combined with the lack of artificial price-control, gives a more favourable outlook to the market.

Daily fluctuations :—

Ordinary. — Thursday, £13 2s. 6d.; Friday, £13 5s.; Monday, £13 11s. 3d.; Tuesday, £13 16s. 3d.; Wednesday, £13 17s. 6d.

Lead.—Prices continue to be influenced by market sentiment and exchange movements, and it is difficult to judge the amount of consumptive support available. The general opinion seems to be that European consumers have been making more inquiries lately, owing to lowness of stocks, but that they are hampered by a continued low demand for their finished products.

The week's prices have been :—

Soft Foreign (*Prompt*).—Thursday, £10 13s. 9d.; Friday, £11; Monday, £11 2s. 6d.; Tuesday, £11 5s.; Wednesday, £11 12s. 6d.

A Method for Microscopic Examination of Bond Distribution.—Mr. A. H. Dierker, in a Paper read before the last meeting of the American Foundrymen's Association, suggests the use of an oil with an index of refraction of 1.55 (which is about the same as that of quartz) for mixing with sand in order to show up, at 43 dia. magnification, the distribution of the clay bond around the silica grains.

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BOILER, SHIP and BRIDGE PLATES, etc. ANGLES and all forms of Sectional Bars. TYRES and AXLES to all requirements. CASTINGS of all kinds and of Largest Sizes. FORGINGS of every description. BILLETS, BLOOMS, RAILS.

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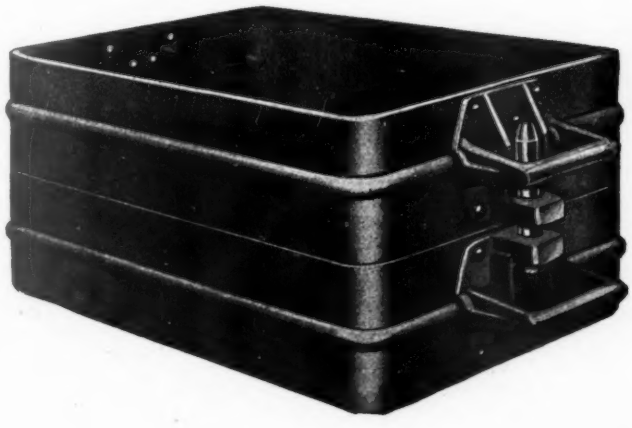

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Manchester: F. L. HUNT & CO., Chapel Street, SALFORD, MANCHESTER.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	31	3	9
Three months	31	5	0
Electrolytic	35	0	0
Tough	32	10	0
Best selected	33	0	0
Sheets	62	0	0
India	44	0	0
Wire bars	35	5	0
Do., Sept.	35	7	6
Do., Oct.	35	10	0
Ingot bars	35	5	0
H.C. wire rods	38	0	0
Off. av. cash, July	26	2	5 9/16
Do., 3 mths., July	25	13	6 9/16
Do., Sttlmnt., July	26	1	10 9/16
Do., Electro, July	29	10	0
Do., B.S., July	28	15	10
Do., wire bars, July	29	17	10 3/16
Solid drawn tubes			10d.
Brazed tubes			10d.
Wire			6 1/4d.

BRASS.

Solid drawn tubes	9d.
Brazed tubes	11d.
Rods, drawn	7 1/2d.
Rods, extd. or rlld.	5 1/2d.
Sheets to 10 w.g.	7 1/2d.
Wire	7 1/2d.
Rolled metal	7d.
Yellow metal rods	4 1/2d.
Do. 4 × 4 Squares	5 1/2d.
Do. 4 × 3 Sheets	5 1/2d.

TIN.

	£	s.	d.
Standard cash	142	15	0
Three months	144	5	0
English	144	10	0
Bars	147	5	0
Straits	148	0	0
Australian	146	7	6
Eastern	149	15	0
Banca	153	7	6
Off. av. cash, July	125	19	5 1/2
Do., 3 mths., July	127	12	3 1/2
Do., Sttlmt., July	125	19	0 1/2

SPELTER.

	£	s.	d.
Ordinary	13	17	6
Remelted	12	15	0
Hard	10	17	6
Electro 99.9	16	5	0
English	14	15	0
India	12	15	0
Zinc dust	20	0	0
Zinc ashes	2	0	0
Off. aver., July	11	15	6 3/4
Aver. spot, July	11	11	10 1/2

LEAD.

	£	s.	d.
Soft foreign ppt.	11	12	6
Empire	11	17	6
English	13	10	0
Off. average, July	9	19	8 3/4
Average spot, July	9	16	4 3/4

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	22	10	0
Do., V.M. ex-whf.	21	10	0
Rods	26	0	0
Boiler plates		—	
Battery plates		—	

ANTIMONY.

	£	s.	d.	£	s.	d.
English	35	0	0 to	42	10	0
Chinese				23	10	0
Crude				16	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	9	5	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.
Ferro-silicon—			
25%	8	5	0
45/50%	13	10	0
75%	19	10	0
Ferro-vanadium—			
35 50%	12,8 lb. Va.		
Ferro-molybdenum—			
70/75% c. free, of Mo.	6/3 per lb.		
Ferro-titanium—			
23/25% carbon-free	11 1/2d. lb.		
Ferro-phosphorus, 20/25%	£22	0	0
Ferro-tungsten—			
80/85%	1/9 lb.		
Tungsten metal powder—			
98/99%	2/- lb.		
Ferro-chrome—			
2/4% car.	£34	0	0
4/6% car.	£25	5	0
6/8% car.	£24	10	0
8/10% car.	£22	7	6
Ferro-chrome—			
Max. 2% car.	£37	0	0
Max. 1% car.	£46	15	0
Max. 0.70% car.	£45	17	6
70% carbon-free	1/1 lb.		
Nickel—80/99.5%	£240 to £245		
"F" nickel shot	£216	0	0
Ferro-cobalt	7/9 lb.		
Aluminium 98/99%	£95	0	0
Metallic chromium—			
96/98%	2/9 lb.		
Ferro-manganese (net)—			
76/80% loose	£10 15 0 to £11	5	0
76/80% packed	£11 15 0 to £12	5	0
76/80% export (nom.)	£9	0	0
Metallic manganese—			
94/96% carbon-free	1/4 1/2 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under 1/4 in. to 1/2 in.	3d. lb.
Do., under 1/2 in. to 3/16 in.	1/- lb.
Flats, 1/2 in. × 1/2 in. to under 1 in. × 1/2 in.	3d. lb.
Do., under 1/2 in. × 1/2 in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£	s.	d.	£	s.	d.
South Wales—						
Heavy steel	1	18	6 to	1	19	0
Bundled steel and shrngs.	1	14	0 to	1	15	0
Mixed iron and steel				1	15	0
Heavy cast iron	2	0	0 to	2	2	6
Good machinery	2	5	0 to	2	7	6
Cleveland—						
Heavy steel				1	15	0
Steel turnings				1	10	0
Cast-iron borings				1	2	6
Heavy forge				2	10	0
W.I. piling scrap				2	2	6
Cast-iron scrap	1	15	0 to	1	16	0
Midlands—						
Light cast-iron scrap				1	15	6
Heavy wrought iron				2	2	6
Steel turnings, f.o.r.				0	19	0
Scotland—						
Heavy steel				1	15	0
Ordinary cast iron				1	18	6
Engineers' turnings				1	8	0
Cast-iron borings				1	10	0
Wrought-iron piling				2	0	6
Heavy machinery				2	4	0

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	22	0	0
Brass	14	0	0
Lead (less usual draft)	8	10	0
Tea lead	7	0	0
Zinc	6	5	0
New aluminium cuttings	72	0	0
Braziery copper	20	0	0
Gunmetal	18	0	0
Hollow pewter	75	0	0
Shaped black pewter	60	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	61/-
Foundry No. 3	58/6
Foundry No. 4	57/6
Forge No. 4	57/-
Hematite No. 1	61/-
Hematite M/Nos.	60/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
d/d Birm.	84/6
Malleable iron d/d Birm.	117/6
Midlands—	
Staffs common*	—
No. 4 forge*	61/-
No. 3 fdry.*	66/-
Shrops basic	—
Cold blast, ord.	—
roll iron	—
Northants forge*	57/6
fdry. No. 3*	62/6
fdry. No. 1*	65/6
Derbyshire forge*	61/-
fdry. No. 3*	66/-
fdry. No. 1*	69/-
basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	72/-
No. 3	69/6
Hem. M/Nos. d/d	68/6
Sheffield (d/d district)—	
Derby forge	58/6
fdry. No. 3	63/6
Lincs forge	—
fdry. No. 3	63/6
E.C. hematite	74/-
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby forge	62/-
fdry. No. 3	67/-
Staffs fdry. No. 3	67/-
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	84/6
Clyde, No. 3	84/6
Monkland, No. 3	84/6
Summerlee, No. 3	84/6
Eglinton, No. 3	84/6
Gartsherrie, No. 3	84/6
Shotts, No. 3	84/6

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.)	9	5	0 to	9	15	0
Nut and bolt iron	7	15	0 to	8	10	0
Hoops	10	10	0 to	12	0	0
Marked bars (Staffs) f.o.t.				12	0	0
Gas strip	10	10	0 to	12	0	0
Bolts and nuts, 1/2 in. × 4 in.				12	0	0
Steel—						
Plates, ship, etc.	8	15	0 to	8	17	6
Boiler plts.	8	7	6 to	9	5	0
Chequer plts.				10	7	6
Angles				8	7	6
Tees				9	7	6
Joists				8	15	0
Rounds and squares, 3 in. to 5 1/2 in.				9	7	6
Rounds under 3 in. to 1/4 in. (Untested)			6 12 6 & up.			
Flats—8 in. wide and over				8	12	6
under 8 in. and over 5 in.				8	17	6
Rails, heavy	8	5	0 to	8	10	0
Fishplates				12	0	0
Hoops (Staffs)				9	10	0
Black sheets, 24g.	8	0	0 to	8	10	0
Galv. cor. shts.	9	5	0 to	9	15	0
Galv. flat shts.	10	0	0 to	10	15	0
Galv. fencing wire, 8g. plain				12	10	0
Billets, soft	4	17	6 to	5	7	6
Billets, hard				6	12	6
Sheet bars	4	15	0 to	5	5	0
Tin bars				4	15	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	10 1/2d.
Sheet to 10 w.g.	11 1/2d.
Wire	11 1/2d.
Rods	10 1/2d.
Tubes	16d.
Castings	12 1/2d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1 1/2 to 1/7 1/2
To 15 in. wide	1/1 1/2 to 1/7 1/2
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2 1/2 to 1/8 1/2
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3 1/2
Ingots rolled to spoon size	10d. to 1/6 1/2
Wire round—	
to 10g.	1/4 1/2 to 1/11 1/2

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3 1/2 upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated

	Dols.
No. 2 foundry, Phila.	14.34
No. 2 foundry, Valley	14.50
No. 2 foundry, Birm.	11.00
Basic	15.39
Bessemer	16.89
Malleable	16.39
Grey forge	16.39
Ferro-mang. 80%, seaboard	68.00
O.-h. rails, h'y, at mill	43.00
Billets	26.00
Sheet bars	26.00
Wire rods	37.00
	Cents.
Iron bars, Phila.	2.11
Steel bars	1.60
Tank plates	1.60
Beams, etc.	1.60
Skelp, grooved steel	1.60
Skelp, sheared steel	1.60
Steel hoops	1.55
Sheets, black, No. 24	2.20
Sheets, galv., No. 24	2.85
Wire nails	1.95
Plain wire	2.20
Barbed wire, galv.	2.60
Tinplates, 100-lb. box	$4.75

COKE (at ovens).

Welsh foundry	20/- to 22/6
furnace	16/- to 16/6
Durham and Northumberland—	
foundry	21/- to 25/-
furnace	12/6
Midlands, foundry	—
furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	15/- to 15/3	
	28×20 "	30/- to 31/-	
	20×10 "	22/- to 22/3	
	18 1/2×14 "	15/6 to 15/9	
C.W.	20×14 "	13/- to 13/3	
	28×20 "	—	
	20×10 "	—	
	18 1/2×14 "	—	

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6	0	0 to	£7	0	0
Bars-hammered, basis	£16	10	0 to	£17	0	0
Bars and nail-rods, rolled, basis	£15	17	6 to	£16	5	0
Blooms	£10	0	0 to	£12	0	0
Keg steel	£32	0	0 to	£33	0	0
Faggot steel	£18	0	0 to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0 to	£12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
Aug.	11 ..	30	7	6	inc.	8/9
,,	12 ..	30	10	0	,,	2/6
,,	15 ..	30	7	6	dec.	2/6
,,	16 ..	30	17	6	inc.	10/-
,,	17 ..	31	3	9	,,	6/3

Electrolytic Copper.

		£	s.	d.		
Aug.	11 ..	34	10	0	inc.	10/-
,,	12 ..	35	0	0	,,	10/-
,,	15 ..	35	0	0	No change	
,,	16 ..	35	0	0	,, ,,	
,,	17 ..	35	0	0	,, ,,	

Standard Tin (cash).

		£	s.	d.		
Aug.	11 ..	142	0	0	inc.	35/-
,,	12 ..	142	10	0	,,	10/-
,,	15 ..	142	5	0	dec.	5/-
,,	16 ..	143	7	6	inc.	22/6
,,	17 ..	142	15	0	dec.	12/6

Tin (English ingots).

		£	s.	d.		
Aug.	11 ..	143	15	0	inc.	35/-
,,	12 ..	144	5	0	,,	10/-
,,	15 ..	144	0	0	dec.	5/-
,,	16 ..	145	5	0	inc.	25/-
,,	17 ..	144	10	0	dec.	15/-

Spelter (ordinary).

		£	s.	d.		
Aug.	11 ..	13	2	6	inc.	7/6
,,	12 ..	13	5	0	,,	2/6
,,	15 ..	13	11	3	,,	6/3
,,	16 ..	13	16	3	,,	5/-
,,	17 ..	13	17	6	,,	1/3

Spelter (Electro, 99.9 per cent.).

		£	s.	d.		
Aug.	11 ..	15	10	0	dec.	5/-
,,	12 ..	15	12	6	inc.	2/6
,,	15 ..	16	0	0	,,	7/6
,,	16 ..	16	5	0	,,	5/-
,,	17 ..	16	5	0	No change	

Zinc Sheets (English).

		£	s.	d.		
Aug.	11 ..	22	10	0	No change	
,,	12 ..	22	10	0	,,	,,
,,	15 ..	22	10	0	,,	,,
,,	16 ..	22	10	0	,,	,,
,,	17 ..	22	10	0	,,	,,

Lead (English).

		£	s.	d.		
Aug.	11 ..	12	15	0	inc.	5/-
,,	12 ..	13	0	0	,,	5/-
,,	15 ..	13	0	0	No change	
,,	16 ..	13	0	0	,,	,,
,,	17 ..	13	10	0	inc.	10/-

Imports and Exports of Iron and Steel Castings in July and the six months 1932, compared with July and the six months 1931.

	July, 1931.	July, 1932.	Six months, 1931.	Six months, 1932.	July, 1931.	July, 1932.	Six months, 1931.	Six months, 1932.
Imports.	Tons.	Tons.	Tons.	Tons.	£	£	£	£
Pipes and Fittings, Cast	1,583	135	8,073	1,850	17,672	1,894	101,956	32,234
Castings, in the Rough, Iron	119	7	1,019	531	2,125	209	20,386	9,476
,, ,, ,, Steel	511	163	3,656	1,208	11,032	3,319	78,181	23,395
Hollow-ware, Cast, not Enamelled	14	8	52	15	855	585	3,559	1,238
,, ,, Enamelled	5	16	42	71	285	458	1,998	2,328
Exports.								
BUILDERS' CASTINGS—								
To Argentine Republic	57	18	545	245	2,413	536	23,975	8,979
,, Irish Free State	362	266	2,313	2,426	17,107	11,476	111,114	107,893
,, British South Africa	249	93	1,209	899	8,456	3,402	46,530	32,245
,, ,, India	66	46	789	530	2,307	1,486	27,396	18,210
,, New Zealand	22	49	257	188	2,209	2,120	16,727	9,251
Total (including other countries)	1,214	762	7,644	6,658	52,964	31,398	341,444	276,076
PIPES AND FITTINGS—CAST—								
To Argentine Republic	152	172	3,535	1,303	1,802	1,746	34,422	13,929
,, Irish Free State	2,052	461	8,768	4,442	21,421	6,522	97,255	61,322
,, British South Africa	493	151	5,170	2,731	6,766	1,774	60,995	33,677
,, ,, India	89	101	943	709	1,631	2,219	16,813	12,096
,, Straits Settlements and Malay States	1,016	37	1,917	1,497	3,230	727	20,627	15,573
Total (including other countries)	7,709	5,489	44,785	40,851	89,774	55,511	513,329	422,594
HOLLOW-WARE—								
Cast, not Enamelled, and Cast, Tinned	187	208	1,341	1,414	6,926	6,910	46,689	50,412
,, Enamelled	47	80	317	477	4,445	6,726	31,253	40,557
CASTINGS, in the rough—								
Iron	490	132	1,667	637	5,740	4,251	35,311	23,737
Steel	94	43	824	474	3,896	2,128	28,849	20,604

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.

ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS WANTED.

FOUNDRY FOREMAN desires position; practical and technical training all branches; grey iron, semi-steel, malleable, die-casting, and all non-ferrous metals. Take entire charge foundry and patternshop.—Box 242, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

WANTED, FOREMAN for Iron Foundry of Marine Engineers on East Coast. Applicants must have had several years as Foreman in full charge and experience in modern methods of moulding and metal production for medium Marine and General Castings. State experience fully, age and wages.—Box 244, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of THE FOUNDRY TRADE JOURNAL.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

PRACTICAL Foundryman, disengaged; last position 13 years, full control; sound experience in Marine Work of all descriptions; dock repairs a speciality, also Lanz process, requires suitable position at home or abroad. (188)

EXPERIENCED and well-known Foundry Manager is open to consider new engagement. Has had complete control of large foundries engaged in all branches of ironfoundry work, from small repetition work to castings of 50 tons. (189)

PARTNERSHIP.

£300 AND SERVICES offered by Metallurgist (39), with wide practical experience, for Partnership in foundry business. —Apply, in confidence, to Box 248, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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with L.M. & S. and L. & N.E. Rlys.

WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

THOS. W. WARD, LTD.,

ALBION WORKS, SHEFFIELD.

FOUNDRY for Sale, with two modern 6-ton Cupolas, Steel Staging, Electric Hoist; Sidings alongside.—Further details, Box 246, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

AUCTION.

By Order of the Liquidator, J. ASH GARLAND, Esq., F.C.A.

Re GENERAL FOUNDRY & ENGINEERING COMPANY, LIMITED (in Voluntary Liquidation).

ARLESEY, BEDS.

HENRY BUTCHER & COMPANY will SELL by AUCTION (unless previously sold) in Lots on the Premises, on THURSDAY, SEPTEMBER 1, 1932, at 11.30 a.m., AS A FIRST LOT, the Valuable

FREEHOLD FACTORY

situate adjoining THREE COUNTIES STATION (L. & N.E. Railway), comprising WELL-LIGHTED BRICK BUILDINGS containing a FLOOR SPACE of 22,000 SQ. FT. Also OFFICES or BUNGALOW RESIDENCE with VACANT LAND FOR EXTENSION, the whole covering a Site Area of about Three Acres. Railway Siding. All Services available. To be followed by the

FOUNDRY PLANT AND EQUIPMENT, including 3-ft. dia. CUPOLA, by Evans, "IMPROVED" and "GENERAL" MOULDING MACHINES, RUMBLER, DOUBLE-ENDED GRINDER, 400 2- and 3-PIECE FOUNDRY BOXES, Crucibles, Blowers, Bogies, LOAM MILLS up to 4 ft. 9 in. dia., 3 Tons No. 3 FOUNDRY PIG-IRON, Iron and Steel Scrap, 55-h.p. "BLACKSTONE" HORIZONTAL OIL ENGINE, 31.5-kw. "G.E.C." ELECTRIC GENERATOR, 210 volts D.C., ELECTRIC MOTORS, 200-230 volts D.C., up to 15 h.p., 4-ft. RADIAL DRILL, 7-in. CENTRE S.S. and S.C. LATHE, Pillar Sensitive Drill, Power Hack Saw, Band Saw, Saw Bench, Mitre Cutter, Office Furniture, etc.

Particulars and Catalogues of :—

MESSRS. A. E. SHERREY GARLAND & COMPANY, Chartered Accountants, 148, Edmund Street, Birmingham; of MESSRS. REDFERN & COMPANY, Solicitors, 23, Colmore Row, Birmingham, or of MESSRS. HENRY BUTCHER & COMPANY, Auctioneers, 63 and 64, Chancery Lane, London, W.C.2.

SALE BY TENDER.

Re WIGSTON FOUNDRY COMPANY, LIMITED, SOUTH WIGSTON, near LEICESTER.

By Order of S. FRED ASPELL, ESQ., F.C.A., the Receiver and Manager,

MESSRS. FULLER, HORSEY, SONS & CASSELL are instructed to offer for SALE by TENDER, in ONE LOT as a GOING CONCERN, on MONDAY, SEPTEMBER 12, the

BUSINESS, GOODWILL AND STOCK-IN-TRADE

of the above Company, which has been established upwards of 40 years and has a high reputation for the quality of its products.

The Work in Progress, Patterns, Drawings, and the Running Contracts are included in the Sale, so that a Purchaser can transfer the Business to his own Foundry. Should he desire to continue it *in situ*, the Freehold Foundry and Engineering Works can be acquired, and ANY OFFER for same with or without the Plant and Machinery would be considered.

Tenders should be enclosed in a sealed envelope marked "Tender *re* Wigston Foundry," and delivered to the Receiver and Manager, S. FRED ASPELL, ESQ., F.C.A., Eagle House, Friar Lane, Leicester, by 4 p.m. on the date above-mentioned.

Further Particulars may be had of MESSRS. ASPELL, DUNN & COMPANY, Chartered Accountants, Eagle House, Friar Lane, Leicester, or of MESSRS. FULLER, HORSEY, SONS & CASSELL, Engineers' Valuers and Factory Agents, 11, Billiter Square, Fenchurch Street, E.C.3.

MACHINERY.

WANTED, Sand Slinger, portable type, not later than 1928.—Reply, Box 238, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

THOMAS C. WILD, LIMITED,
Electrical and Mechanical Engineers,
FREEDOM WORKS, JOHN STREET, SHEFFIELD.

SECONDHAND BLOWERS, IN FIRST-CLASS CONDITION.

ONE 12-in. KEITH BLACKMAN CUPOLA BLOWER, Motor 220/250 volts D.C., 40 h.p., 1,630/2,800 r.p.m. Complete with new Brookhirst Controller Panel.

Two 12-in. BLOWERS similar to above by APPLEBY, Motor 31 h.p., 1,450 r.p.m., 440 volts, 3-phase, 50 periods.

One 12-in. BELT-DRIVEN STURTEVANT BLOWER. Motor and Controller for A.C. or D.C. can be supplied from stock.

One NEW 9 in. ROOTS BLOWER by THWAITES, Belt-driven.

All Electrical Equipment sold by us carries our usual 12 months' guarantee.

THOS. W. WARD, LTD.

Worthington Hori. Duplex Pump, 10" x 6" x 10".

Hori. 3-throw Hyd. Pumps, 3½" rams, 12" str., 1,500 lbs. press.

Vert. 3-throw Geared Hyd. Pumps, 2" rams x 6" str., 1,500 lbs. press.

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'Grams: Forward. 'Phone, 23001 (10 lines).

"Albion" Catalogue on application.

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Power and Hand Moulding Machines, Sand Mills and Disintegrators, Sand Blast Plants, Ladles, Melting Furnaces, Grinding Machines, Blowers and Exhaust Fans, Air Compressors, etc., etc.

Also 300 A.C. and D.C. Electric Motors, ¼ to 200 h.p., and Generators, to suit most systems.

All at low prices. Please send your inquiries to :—

215, BARCLAY ROAD, WARLEY,
Nr. Birmingham.

'Phone : Bearwood 1103.

WORKS ADDRESS : Crosswells Road (next G.W.R. level crossing), Langley, near Birmingham. 'Phone : Broadwell 1359.

MISCELLANEOUS.

OUR DEXTRIN CORE GUM, reliable strength, has a reputation all over England as well as abroad. Please post us your inquiry, stating quantity, for carriage-paid terms.—WILLIAM OLSEN, LIMITED, The Foundry Suppliers, Hull.

STRAW ROPES, own make, always at lowest carriage-paid terms. We invite orders and/or inquiries. Also Wood Fibre Core Ropes, all sizes.—WM. OLSEN, LIMITED, Cogan Street, Hull.

'Phone: 287 SLOUGH

LADLES—GEARED

12-Ton "Stevenson"	... ...	£48
9-Ton "MacNeil"	... ...	£42
4-Ton "Evans"	... ...	£28
3-Ton "Evans"	... ...	£24
2-Ton "Evans"	... ...	£19

PNEUMATIC MACHINES

18"×18" Tabor split pattern	£45
30"×40" Tabor rollover ...	£160
No. 2 Britannia Jolters	... 2 @ £36
No. 0 Britannia Jolters	... 4 @ £20
Core Jolters, 3" Cylinder new, £4 each	

ABOVE ARE AS NEW.

BUY FROM ME AND SAVE MONEY!

ALEX. HAMMOND, *Foundry Machinery Merchant,*
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